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American Statistical Association

Organized November 27, 1839
Incorporated 1841

The American Statistical Association is a scientific and educational organization. Its membership is not confined to professional statisticians but includes economists, business executives, research directors, government officials, university professors, and other persons who are seriously interested in the application of statistical methods to practical problems, in the development of more useful methods, and in the improvement of basic statistical data. Engineers, mathematicians, biologists, actuaries, sociologists, psychologists, and representatives of many other professions are included in the membership of the Association. Information about the Association and membership application forms may be secured from the Secretary, R. L. Funkhouser, 1626 K Street, N.W., Washington, D. C.

The 102nd Annual Meeting of the American Statistical Association will be held in Chicago, Illinois, December 26 to 28, 1940. With a few exceptions the sessions are open to the public.

Chapters of the Association have been organized in important cities in the United States. Information concerning the meetings of these chapters may be secured from the District Representatives listed on another page.

The Editors welcome the submission of articles and notes for possible publication in the JOURNAL. Manuscripts should be sent to the Editor, Journal of the American Statistical Association, 1626 K Street, N.W., Washington, D. C. Books for review should be sent to the Review Editor, Glenn E. McLaughlin, 210 Normandy Building, 1626 K St., N. W., Washington, D. C. Authors who wish suggestions about the preparation of manuscripts and charts or information about editorial policies should address their inquiries to the Editor.

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JOURNAL OF THE AMERICAN STATISTICAL ASSOCIATION

Number 212 DECEMBER, 1940 *Volume 35*

THE TREND OF THE BIRTH RATE BY AGE OF MOTHER AND ORDER OF BIRTH*

By Alfred J. Lotka and Mortimer Spiegelman
Metropolitan Life Insurance Company

It is, by now, a familiar fact that the downward course followed for many years by our crude birth rate came to its low point in 1933, and since then has shown a tendency towards stability at a level about 17 per 1,000, as shown in Fig. 1. The movement of the crude birth rate,

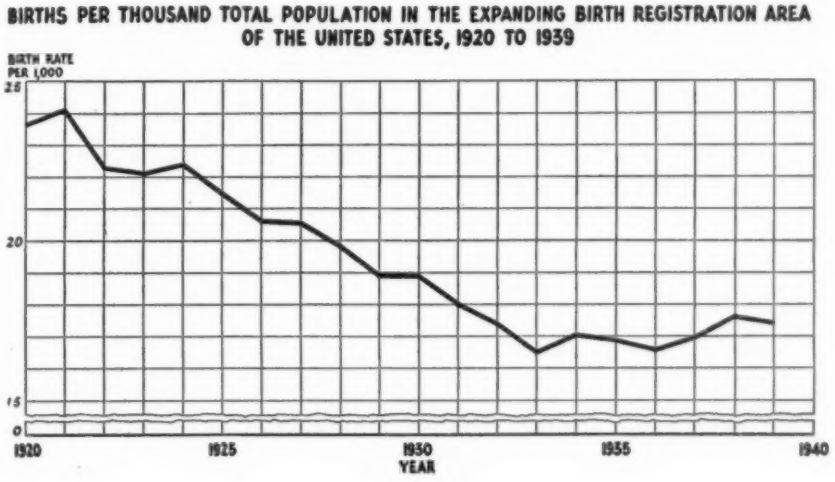


FIG. 1

however, hides a number of separate and in fact contradictory trends which are brought to light when the births are analyzed with regard to the age of the mother with further distinction according to the order of child at birth.[1]

With this in view, an analysis is now presented of the trend of reproduction rates in the United States. The series of rates computed begins with 1920 and extends to 1938, and relates to all but a few states of the expanding Birth Registration Area.[2] In computing the rates, no at-

* Paper presented before the Population Association of America, at Chapel Hill, N. C., May, 1940.

[1] For prior publications bearing on this subject see the bibliography at the end of this article.

[2] The States excluded are as follows:
1924–27: Delaware, Maine, Massachusetts, New Hampshire, and Rhode Island

tempt has been made to correct for under-registration of births. The populations by age used as a basis for the rates were found by linear interpolation for the years 1920 to 1930, and by survivorship for the years since 1930. Any loss of accuracy resulting from these two factors, namely under-registration and estimates of population by age, may in some degree affect the rates here presented, but hardly enough to seriously influence the aspect of the main underlying movements. The data relate to the white population only.

Considering, first, children of all orders of birth, but classified according to age of mother, we have the situation presented in Fig. 2. It will be observed that among females in the age group 15 to 19 years (shown as a dashed curve in the lower portion of the chart) the maternity frequency has shown a greater stability than at practically all the higher ages. It is also clearly evident that maternity frequency in the age group 25 to 29 years has decreased more rapidly than in the group 20 to 24 years, for the two curves cross in 1926. Before that time, reproductivity was at its maximum in the age group 25 to 29 years; since 1926 the maximum has been in the group 5 years younger.

The essential feature of Fig. 2 appears in the later end of the curves. It should be noted that each of the curves for the age groups 15 to 19, 20 to 24 and 25 to 29 reach a minimum in 1933 and then show a tendency to move upward. In the case of the age group 20 to 24, the tendency is very pronounced. On the other hand, for every one of the age groups after age 35, the general downward movement of the maternity frequency has continued, with rare interruptions, through 1938. Thus, it is apparent that the halt in the decline of the crude birth rate observed on Fig. 1 in 1933 is not fully understood when taken in the gross, but requires such examination of its ingredients as here presented.

From this analysis of births by age of mother, let us pass now to an analysis by order of birth. For this purpose, maternity frequencies have been computed separately for each order of birth within each quinquennial age group of women in the reproductive period. Then the frequencies were summed for all these quinquennial age groups so as to give a total for each order of birth, without regard to the age of the mother; the results are shown in Fig. 3, in which a separate curve has been drawn for each order of birth as far as the twelfth child.

Up through 1933, the curve for each order of birth has a distinct

1928–29: Colorado, Maine, Massachusetts, New Hampshire, and Rhode Island
1930–31: Texas, South Dakota and the states as for 1928–29
1932 : Texas and the states as for 1928–29
1933 : Colorado, Massachusetts, and New Hampshire
1934–38: Massachusetts and New Hampshire

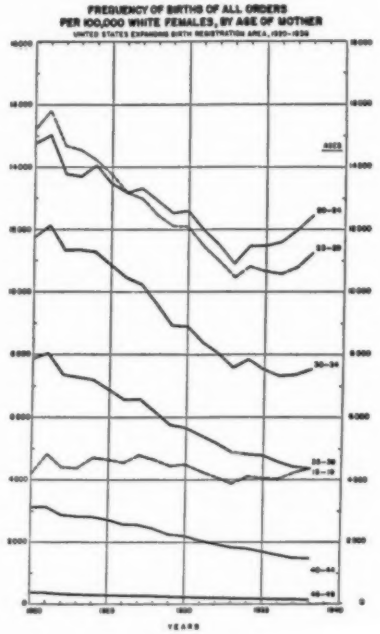


FIG. 2

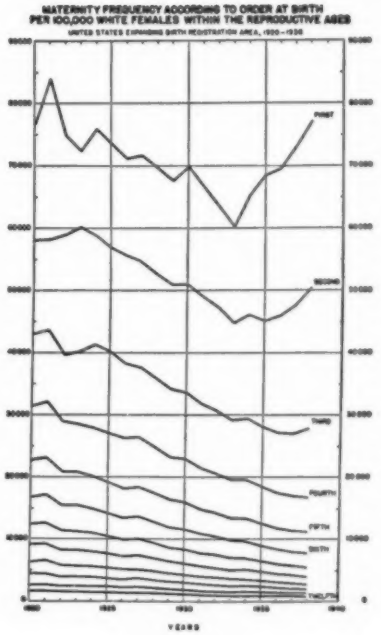


FIG. 3

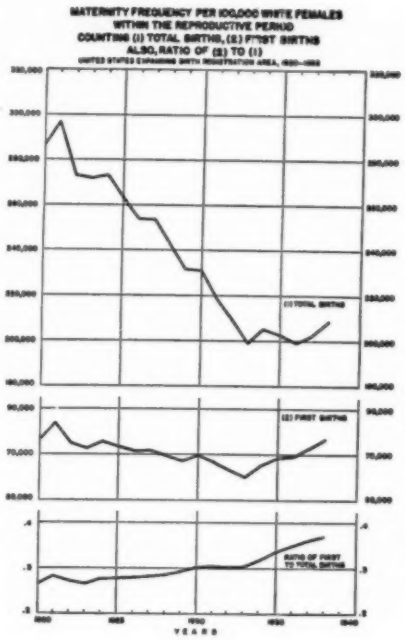

MATERNITY FREQUENCY PER 100,000 WHITE FEMALES
WITHIN THE REPRODUCTIVE PERIOD
COUNTING (1) TOTAL BIRTHS, (2) FIRST BIRTHS
ALSO, RATIO OF (2) TO (1)
UNITED STATES EXPANDING BIRTH REGISTRATION AREA, 1920–1936
(1) TOTAL BIRTHS
(2) FIRST BIRTHS
RATIO OF FIRST TO TOTAL BIRTHS
YEARS

FIG. 4

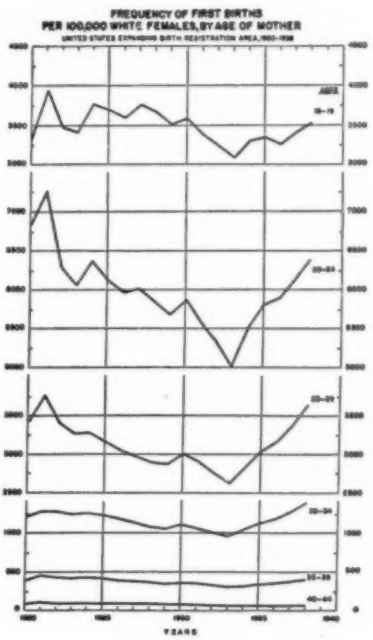


FIG. 5

downward trend. However, the year 1933 marks an important turning point. Beginning with that year, the curve for first children starts on a steep upward climb which continues through 1938, the last year of the series, to a level higher than that for any year since 1921. The year 1933 also marks a turning point for the curve of maternity frequencies of second children, but the upward movement in this case is by no means as sharp as for first children. In contrast to the situation just described, the curves for the third and higher order of children show, in 1933, only a slight halt in their general downward movement. For the fourth and higher orders, in every case, the point for the latest year is the lowest in the curve. It is evident, from this description that the course of the birth rate in recent years is strongly influenced by the course of the maternity frequency of first births. This important fact is emphasized by the lowermost curve in Fig. 4, which shows the trend of the ratio of the maternity frequency, for all ages within the reproductive period, of first births to that of total births. It will be noted that the ratio of first births to total births increased slowly from about 27 to 30 per cent during the period from 1920 to 1933. Thereafter, the rise was very rapid, reaching a maximum of 37 per cent in 1938, the latest year of our series.

A brief comment is in order regarding the course of the curve for the maternity frequency of the first child. An earlier study[3] of the rates of first births in New York State for the period from 1919 to 1937 has shown that, almost without exception, an increase in the marriage rate from one year to the next was followed—with a lag of one year—by an increase in the birth rate of first children. When we recall the high correlation that has been found to exist between the marriage rate and economic conditions[4] it is to be expected that the time series of first births will also be closely correlated with economic conditions. Furthermore, since we have seen that the birth rate is being influenced in increasing degree by the maternity frequency of first births, it appears that economic conditions are playing a greater role than in the past in determining the course of our birth rate.

In the several charts remaining, there are shown maternity frequencies for each order of birth according to the age of the mother. In Fig. 5, which relates to first births, it will be observed that all but the very highest age group shown shared in the rise in maternity frequencies since 1933. The points for 1938 in the curves for the ages from 20 to 34 reached levels prevailing only in the early years of the series. The curves

[3] *Statistical Bulletin of the Metropolitan Life Insurance Company*, May 1939, p. 6.
[4] *Statistical Bulletin of the Metropolitan Life Insurance Company*, July 1938, p. 1.

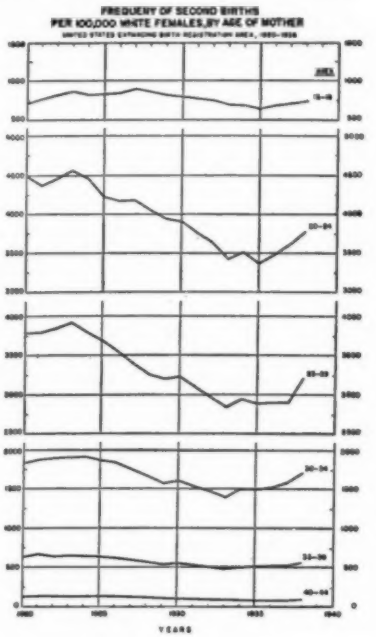


FIG. 6

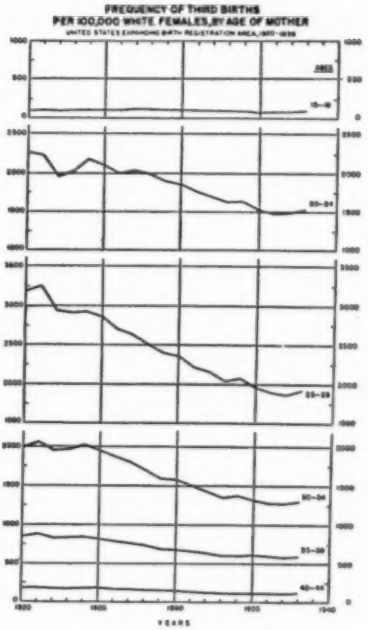


FIG. 7

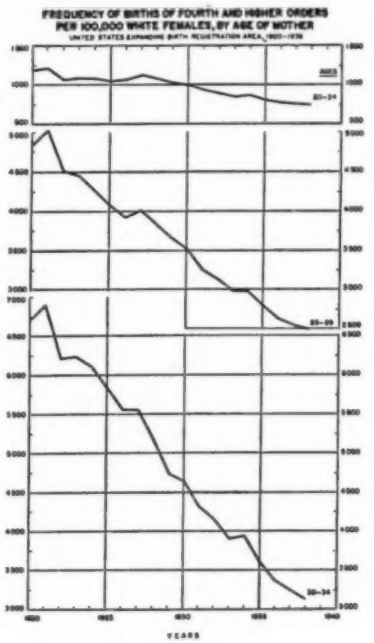


FIG. 8

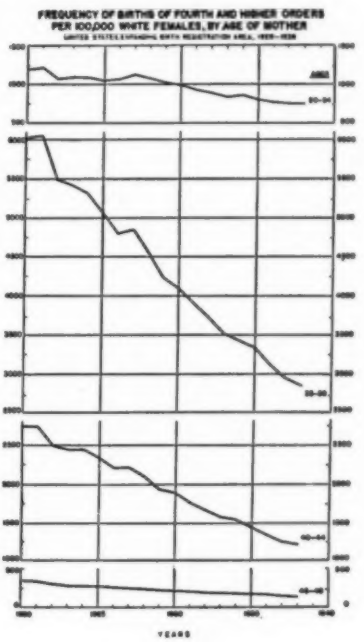


FIG. 9

for maternity frequencies of second child (Fig. 6) show some evidence of an upward movement since 1933 in several age groups, but the tendency is not very strong. The next three charts (Figs. 7, 8, 9) set forth the maternity frequencies for the third child by age of mother, and also for fourth and higher orders of birth by age of mother. In every one of these charts, the curves continue downward to their lowest points in the most recent years. It is particularly interesting to note the very sharp declines in the curves for the fourth and higher orders. Each curve fell to about half its original level from 1920 to 1938.

TABLE I

AVERAGE AGES OF MOTHERS AT EACH ORDER AT BIRTH COMPARED FOR THE PERIODS 1920–1924 AND 1934–1938; UNITED STATES EXPANDING BIRTH REGISTRATION AREA, WHITES ONLY

Order of child at birth	Average age of mother	
	1934–1938	1920–1924
All orders	27.7 yrs.	28.7 yrs.
First	23.7	23.8
Second	26.4	26.5
Third	28.5	28.7
Fourth	30.4	30.5
Fifth	32.0	32.2
Sixth	33.5	33.7
Seventh	34.9	35.2
Eighth	36.2	36.5
Ninth	37.4	37.7
Tenth	38.4	38.8
Eleventh and over	40.1	40.3

The radical changes in maternity frequencies from 1920–24 to 1934–38 have had only a very slight influence on the average age of the mother at each order of birth, as will be seen in Table I. However, for all orders of birth combined, there has been a reduction of just about one entire year in the average age of the mothers. This effect is due to the greater proportion of births of lower orders in the more recent period.

Of the two terms whose difference determines the rate of natural increase, namely births and deaths, the first are by far the more elastic, the quicker to respond to changing conditions, the greater in capacity for wide variation. Any intensive study of the movement of population must necessarily include as one essential an examination of the separate components of the total reproductive performance along such lines as here set forth.

The following references are here noted for convenience. They are not intended in any sense as a complete bibliography.

Kiser, C. V., "Recent Trends in Birth Rates among Foreign and Native White Married Women in Upstate New York." *Milbank Memorial Fund Quarterly*, vol. 14, April 1936, pp. 173–179.

Kiser, C. V., "Trends in Annual Birth Rates among Married Women in Selected Areas According to Nativity, Age and Social Class," *Milbank Memorial Fund Quarterly*, vol. 15, Jan. 1937, pp. 1–27.

Stouffer, S. A. and Lazarsfeld, P. F., "The Family in the Depression." Published by the Social Science Research Council, 1937. See especially Chapter V entitled "Births in the Family."

National Resources Committee, "Population Statistics: #2, State Data," 1937, pp. 1–8.

Charles, Enid, "The Changing Structure of the Family in Australia," *Economica*, vol. 4, Aug. 1937, p. 245.

Pearl, Raymond, "Natural History of Population," Oxford Press, London, 1939.

Shryock, H. S., Jr., "Trends in Age Specific Fertility Rates," *Milbank Memorial Fund Quarterly*, vol. 17, July 1939, pp. 294–307.

Ciocco, A., "Trend in the Proportional Contribution of the Socio-Economic Groups to Natality," *Human Biology*, vol. 12, May 1940, pp. 188–202.

Myers, R. J., "Population, Birth and Mortality Trends in the United States," *Transactions of the Actuarial Society of America*, vol. 41, May, 1940, pp. 66–102.

THE EFFECTS OF FEDERAL REVENUE ACTS OF 1938, 1939, AND 1940 ON THE REALIZATION OF GAINS AND LOSSES ON SECURITIES

By Q. Forrest Walker, W. T. Collins, and D. E. Higgins
R. H. Macy & Co., Inc.

The purpose of this study is to examine certain mathematical aspects to be considered in realizing capital gains and losses on securities under the Federal Revenue Acts of 1938, 1939, and 1940. The fiscal wisdom of the tax treatment of these gains and losses is not here the subject of discussion; but the formulae subsequently developed may prove useful to persons interested in the economic appraisal of this feature of the tax system. This analysis is directed mainly to the problems of the security holder who is confronted with the question of realizing capital gains and losses and who may require mathematical aid in reaching a decision.

In the process of appraising security holdings, the question of sale of certain securities and reinvestment of funds continuously arises. Such transactions should not be undertaken without full knowledge of the effects of the tax treatment of the capital gains or losses to be realized. Thorough analysis of these effects may have important bearing on the decision to be made. The sole purpose of this article is to provide for the investor a reasonably simple method for evaluating the tax factor.

The Revenue Act of 1938[1] further modified the specialized treatment of gains and losses from sales of securities and other similar property under prior legislation. This statute defines "capital assets" to exclude property held primarily for sale in the ordinary course of trade and property included in the inventory of the taxpayer conducting a business; and it also excludes property that is subject to a statutory depreciation deduction. Stocks and bonds are the most important but not the only type of asset falling within the definition of "capital assets."

Gains and losses from sale of capital assets are divided into two broad classes: (a) "short term" if the property has been held not more than 18 months; and (b) "long term" if it has been held longer than 18 months.

Individual taxpayers are permitted to offset short term gains with short term losses. If a *net* short term gain is realized, it is included in the gross income of the taxpayer; if a *net* short term loss is realized, it may not be deducted from gross income but it may be used in an amount not in excess of the net income for such year as an offset to net

[1] *Revenue Act of 1938*, Sec. 117.

short term capital gains in the succeeding taxable year.[2] Long term capital gains and losses are taken into account for tax purposes to the extent of 66⅔ per cent of their respective amounts when obtained from the sale of capital assets held more than 18 months but not more than 24 months; and to the extent of 50 per cent of their respective amounts when the holding period exceeds 24 months.

Under the Revenue Act of 1938, corporate taxpayers[3] were limited to a maximum deductible net loss on capital assets of $2,000, regardless of the length of time held, but special exception was made for losses on certain securities by banking corporations. The Revenue Act of 1939, however, accords corporations[4] more liberal treatment of capital gains and losses realized in taxable years beginning after December 31, 1939. They are allowed to deduct net long term capital losses, but short term capital losses are deductible only to the extent of short term gains. Corporations are to be permitted to carry forward net short term losses to the succeeding taxable year in the same manner as provided for individuals. Unlike individual taxpayers, corporations must include the full amount of long term capital gains and losses in the computation of net income.

The Revenue Act of 1940 has made no changes in the treatment of capital gains and losses. Among the significant features of this Act, however, are increases in the surtax rates in certain brackets and the imposition of a defense super-tax of 10 per cent upon the total amount of tax as regularly computed by the taxpayer. All calculations and illustrations in this article are based on the tax rates under the Revenue Act of 1940.

Both individuals and corporations include net short term capital gains in gross income and to the extent that such gains are ultimately reflected in net income, they bear the regular normal tax and surtax rates or the corporate tax rates. Long term capital gains and losses of corporations are treated like other items of income and deduction, but for individuals the statute provides for alternative taxes upon net long term capital gains or losses taken into account.

If the individual taxpayer has realized a net long term capital gain, he is required to compute normal tax and surtax upon his net income exclusive of this gain, and to the partial tax so determined, he must add

[2] *Ibid.*, Par. 299 (e): "Net Short-Term Capital Loss Carry-over.—If any taxpayer (other than a corporation) sustains in any taxable year a net short-term capital loss, such loss (in an amount not in excess of the net income for such year) shall be treated in the succeeding taxable year as a short-term capital loss except that it shall not be included in computing the net short-term capital loss for such year."

[3] *Ibid.*, (d).

[4] *Revenue Act of 1939*, Sec. 212.

30 per cent of the net long term capital gain taken into account.[5] This is the alternative tax. The taxpayer then makes a further computation of normal tax and surtax upon his ordinary net income increased by the amount of his net long term capital gain taken into account. His final tax is the *lesser* of the two amounts, increased in the amount of ten per cent to cover the defense super-tax.

If the individual taxpayer has a net long term loss, he is required to compute normal tax and surtax upon his net income exclusive of his loss and from the partial tax so determined he must deduct 30 per cent of the net long term capital loss taken into account.[5] This is the alternative tax in case of such losses. He then makes another computation of normal tax and surtax upon his ordinary net income reduced by the amount of his net long term capital loss taken into account. His final tax is the *greater* of the two amounts, increased in the amount of ten per cent to cover the defense super-tax.

Disregarding the credit for earned income and adjustments for interest exempt from normal tax, it is possible to define mathematically the income levels that require use of the alternative method of computation. If the taxpayer has net *long* term capital gains, he has the advantage of the alternative method when his ordinary net income after personal exemptions is $22,000 or more, and this holds true irrespective of the amount of such gains. It is also true that if net *long* term capital gains taken into account, regardless of the amount of ordinary net income, equal or exceed $56,777.78 the alternative method is used. For smaller amounts of gain and smaller ordinary net income, the applicable method must be specifically determined.

Similarly, in the case of net long term loss taken into account of $56,777.78 or more, the alternative method must be used no matter what the amount of the ordinary net income may be. Or if the ordinary net income after exemptions is $56,777.78 or more, the alternative method is required irrespective of the amount of net long term loss.

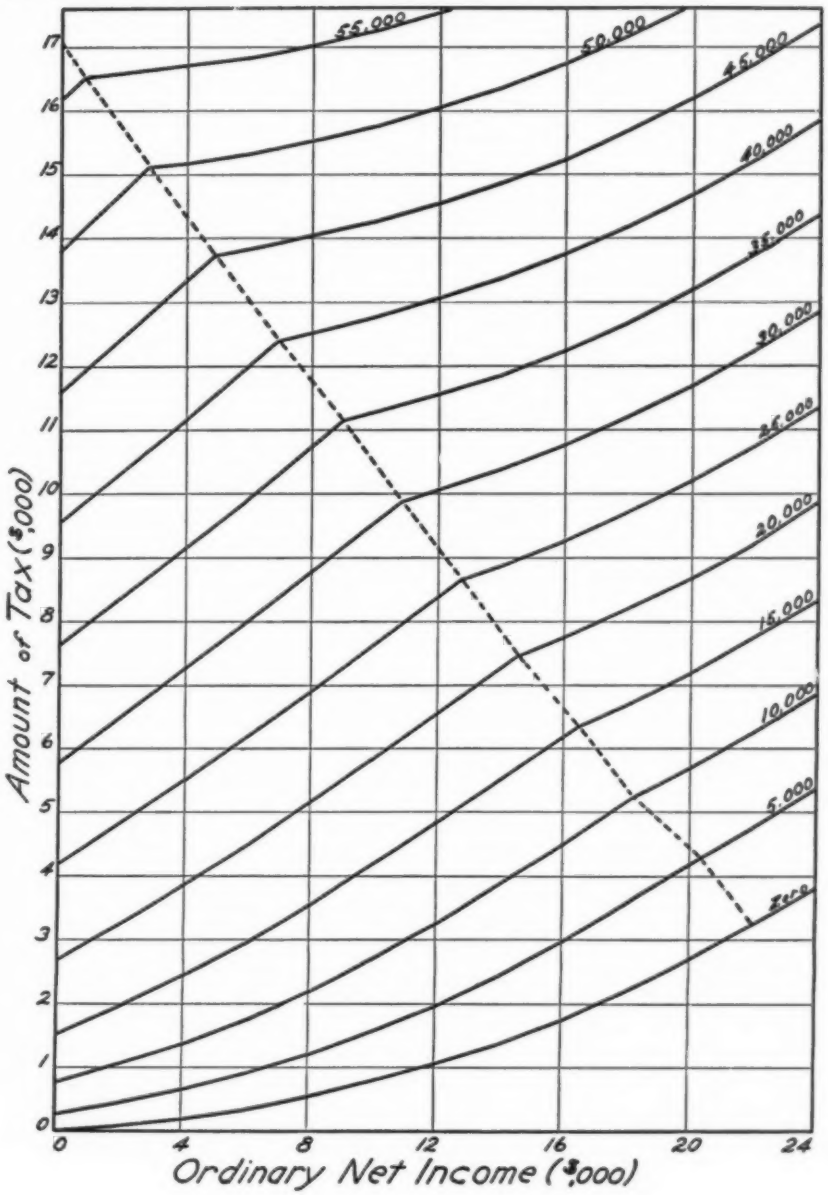
Charts I and II have been prepared to show graphically the application of the two methods of calculating tax. They provide a quick way to determine which of the two methods must be employed. They also show the approximate amount of tax, not including the super-tax. In border line cases it is necessary to calculate the tax by both methods. This results from difficulties in reading the charts accurately and the adjustments necessary for the earned income credit and credits for income exempt from normal tax.

[5] I.e., 20 per cent of the full amount (of gain or loss) if the asset has been held for 18–24 months, and 15 per cent if held longer than 24 months. To these rates must be added the super-tax, making the effective rates 22.0 per cent and 16.5 per cent respectively.

CHART I

AMOUNT OF TAX PAYABLE FOR ASSUMED AMOUNTS OF ORDINARY NET INCOME AND NET CAPITAL GAINS TAKEN INTO ACCOUNT

(Dotted line shows points at which alternative method of calculating tax becomes operative. Net income is after credit for personal exemptions but without allowance for any other credits against net income for normal tax. Amount of tax shown does not include 10 per cent super-tax.)



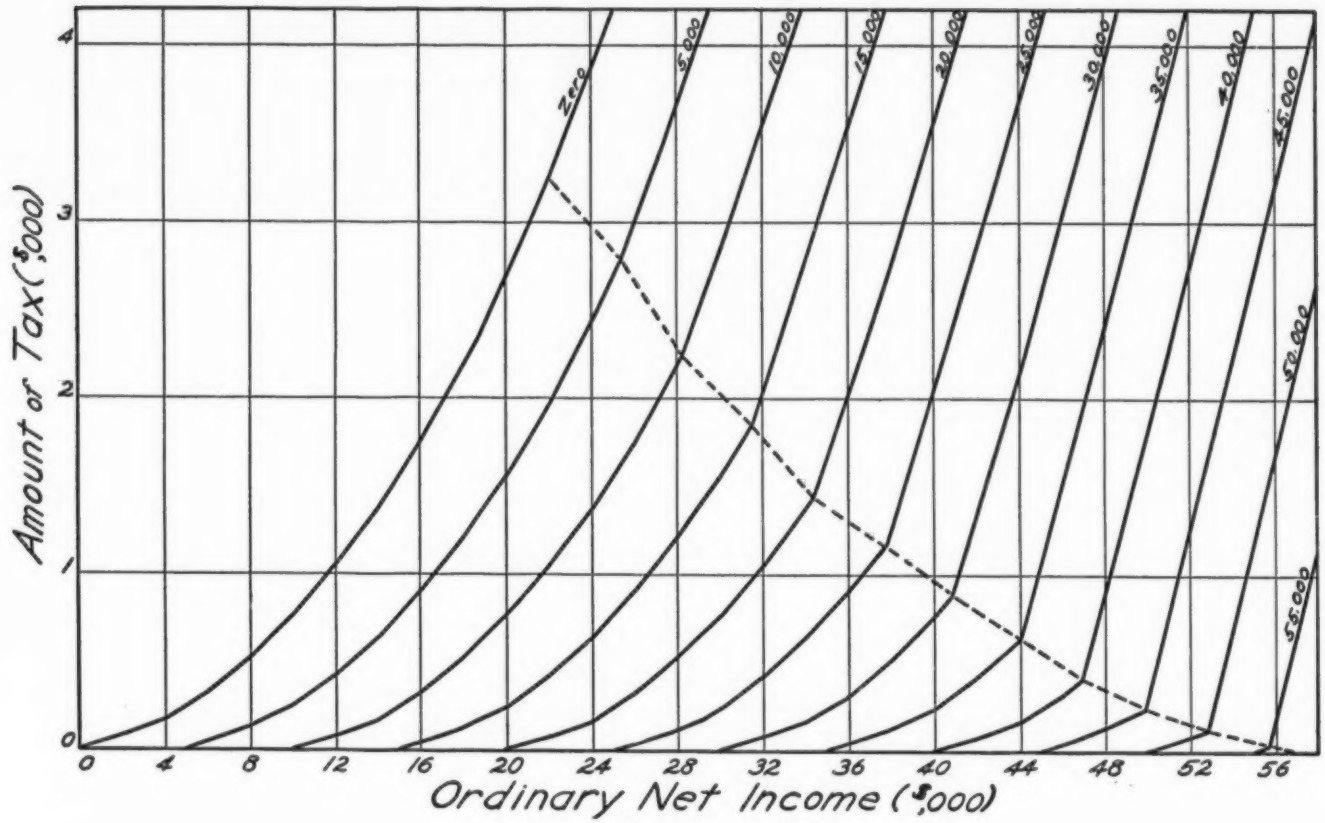


CHART II

AMOUNT OF TAX PAYABLE FOR ASSUMED AMOUNTS OF ORDINARY NET INCOME AND NET CAPITAL LOSSES TAKEN INTO ACCOUNT

(Dotted line shows points at which alternative method of calculating tax becomes operative. Net income is after credit for personal exemptions but without allowance for any other credits against net income for normal tax. Amount of tax shown does not include 10 per cent super-tax.)

(Dotted line shows point at which alternative method of calculating tax becomes operative. Net income is after credit for personal exemptions but without allowance for any other credits against net income for normal tax. Amount of tax shown does not include 10 per cent super-tax.)

THE REALIZATION OF CAPITAL GAINS

When a taxpayer is contemplating sale of present holdings and reinvestment of the proceeds, if his statutory capital gains are always offset by corresponding losses, taxation presents no problem. Under this condition, his principal requirement is that the new commitments should have greater possibilities of appreciation than the old commitments.

If the contemplated sale produces a net capital gain, the new investment must appreciate relative to the former holding by an amount at least equal to the tax payable upon the gain. This is the immediate handicap placed upon the new purchase. This handicap is greater as the tax rate and the percentage of gain on the original investment increase. The formula for computing the required tax-compensating gain in market value is derived as follows:

When C = Cost of original issue
M = Market value of the original issue
T = Rate of tax on capital gain
R = Percentage of gain realized on the original issue
R' = Percentage of gain required on the new purchase to regain the market value of the original issue at the time of sale
then $(M-C)T$ = Amount of tax on capital gain; and
$(M-C)T$ = Amount of gain on new issue required to compensate for the tax

and
$$R' = \frac{(M - C)T}{M - (M - C)T}.$$

But $(M-C)/C = R$; $M/C = R+1$; and $(M-C) = RC$.
Substituting terms, the equation becomes

$$R' = \frac{RT}{1 + R - RT}.$$

APPLICATION OF THE GAINS FORMULA

This formula may be used to compute the tax handicap on both short and long term capital gains. For short term net gains, the applicable tax rate is the sum of the normal tax rate and the surtax rate imposed in the brackets in which the realized gain falls, plus the super-tax. In the case of a long term net gain, when the alternative method of calculating tax does not apply, the applicable tax rate is also the sum of the

normal tax rate and the surtax rate imposed on the net long term gain taken into account, plus the super-tax. If the taxpayer is required to pay tax under the alternative method, the applicable tax rate is 22 per cent, or 16.5 per cent, depending upon the period of holding.

Illustrating the first case, if the taxpayer within the past eighteen months has bought a common stock at $50 a share and now proposes to sell it at $80 a share, he realizes a short term gain of 60 per cent.[6] If his income falls in the $100,000 to $150,000 surtax bracket, the total normal tax and surtax is 62 per cent,[7] and the super-tax of 10 per cent makes the total rate 68.2 per cent. Applying the formula to this set of facts, R' is 34.4 per cent. In other words, if the proceeds of sale after deducting tax on the capital gain are to be reinvested, over 34 per cent gain must be obtained on the new purchase to recoup the market value of the original holding.

If the proposed realizable gain in the foregoing illustration had been a net long term capital gain taxable at a 16.5 per cent rate, R' would have had a value of 6.6 per cent. This tax handicap on the new investment may not be a deterrent to sale. But if to the capital gains tax rate are added the income tax rates imposed upon the gain under various state income tax laws, the handicap may be increased substantially.

Table I below lists various values for R' when R ranges from 10 to 300 per cent and the taxpayer is liable for state and federal taxes totaling 24.5 per cent upon net capital gains.[8]

From the table it is apparent that, other things being equal, the greater the percentage of capital appreciation, the less is the desirability of realizing capital gains. This may restrict the free flow of capital funds because the taxpayer may estimate that it is safer to retain the original holding so long as the tax laws impose such a handicap upon its sale. The tax laws also tend to create artificial barriers to the free flow of venture capital by an arbitrary time distinction between short and long term capital gains. Since net short term capital gains are subject to normal tax and surtax, the tax upon such gains becomes very large as the net taxable income rises, but retention of the holding longer than 18 months reduces the tax rate in all instances to a maximum of only 16.5 or 22.0 per cent, including defense super-tax.

[6] In all examples, it is assumed that the security prices are after payment of required commissions and taxes.

[7] This assumes that the surtax rate of the highest bracket is applicable to the capital gain. This is the view generally entertained in investment circles, but good argument can be advanced for using the average rate of tax on the total income. If the income is $150,000, the average tax rate, including super-tax, is 52.6 per cent and R' would be 24.6 per cent.

[8] This assumes a federal alternative tax of 16.5 per cent plus the maximum New York State income tax rate of 8 per cent currently imposed on net income including capital gains from securities. This is an approximation inasmuch as the state tax is a deduction from income in computing the federal tax.

TABLE I

PERCENTAGE OF GAIN REQUIRED ON NEW COMMITMENT TO RECOUP MARKET VALUE OF ORIGINAL COMMITMENT[8]

(When capital gain is realized on original commitment)

Gain on original commitment	Gain required on new commitment when $T = 24.5$ per cent
R	R'
10	2.3
20	4.3
30	6.0
40	7.5
50	8.9
60	10.1
70	11.2
80	12.2
90	13.1
100	14.0
200	19.5
300	22.5

THE REALIZATION OF CAPITAL LOSSES

The next problem to be considered is that in which the original purchase shows a loss at the contemplated selling price when there are no offsetting capital gains. The objective in the capital gains formula was determination of the necessary percentage appreciation on the second purchase to recoup *the market value* of the security sold. In this problem the objective is a formula for the percentage appreciation needed on the second purchase to permit restoration of the *original capital investment.* There would, of course, be no tax if a security that now shows a loss at current market were held until it reached its cost price and then were sold. But its present sale at a loss would make necessary sufficient appreciation of the new purchase to provide after sale and payment of taxes on the realized gain an amount equal to the original capital investment.

For this general case it is necessary to develop a formula in which two rates are present. One rate is needed to determine the amount of taxes saved because of the loss realized on the original issue, and the other is needed to ascertain the tax payable on the realized gain when the second purchase is sold. In some instances the rate of tax saving on the capital loss may be the same as the tax rate applicable to the capital gain on the new purchase. This, however, is a special case. The formula developed below is for the general case in which the two tax rates differ. The capital loss formula is derived as follows:

When C = Cost of the original investment
M = Current market value of the original investment
T = Percentage of loss saved on the original investment by application of the tax law
T' = Rate of tax applicable to the gain realized by sale of the second investment
R = Percentage of loss on original investment
R' = Percentage of gain required on second investment to regain the original capital

It is apparent that $(C-M)T$ is the amount of tax saving resulting from the loss on the sale of the original investment. Therefore, $M+(C-M)T$ is the sum available for purchase of the second investment: Let this be represented by K. When X is the required selling price of the second investment, $X-K$ is the capital gain and the amount of tax is $(X-K)T'$. Since the selling price of the second investment must be sufficiently great to permit payment of tax on the gain and leave an amount equal to the original capital (C),

$$X - (X - K)T' = C$$

or

$$X = \frac{C - KT'}{1 - T'},$$

but

$$R' = \frac{X - K}{K},$$

therefore

$$R' = \frac{1}{K}\left(\frac{C - KT'}{1 - T'} - K\right) = \frac{C - K}{K(1 - T')}$$

Substituting $M+(C-M)T$ for K

$$R' = \frac{(C - M)(1 - T)}{[M + (C - M)T](1 - T')}$$

Substituting

$$R = (C - M)/C;\ (C - M) = RC, \text{ and } M/C = 1 - R$$

The formula is simplified to

$$R' = \frac{R(1 - T)}{(1 - R + RT)(1 - T')}.$$

APPLICATION OF THE CAPITAL LOSS FORMULA[9]

The four conditions to which this formula may be applied are:

Capital loss on sale of first investment	*Capital gain on sale of second investment*
Short term	Short term
Short term	Long term
Long term	Short term
Long term	Long term

For example, assume that a taxpayer bought a common stock at 120 over two years ago and now decides to take a long term loss of 25 per cent by selling the stock at 90. He desires to reinvest in some stock that holds promise of appreciation to such an extent within 18 months as to permit its sale, payment of tax on the gain, and a net realization equal to his first cost of 120. If the alternative method applies in the case of the long term loss and there is a 40.7 per cent tax on the short term gain, what price must be realized on the second sale to restore his original capital outlay? Using the formula,

$$R' = \frac{.25(1 - .165)}{(1 - .25 + .25 \times .165)(1 - .407)} = 44.5 \text{ per cent.}$$

Therefore, the selling price of the second issue must be larger than its cost by this percentage, i.e. the 94.95 available for investment in this second issue must appreciate to 137.2.[10]

If the taxpayer holds the second issue longer than two years so as to realize a net long term capital gain with a tax rate of 16.5 per cent, the formula shows that R' is 31.6 per cent and the required selling price becomes 124.9.

Table II shows the magnitude of the long term capital gains required to recoup the taxpayer's original capital under differing conditions of net capital loss and assumed rates of tax. Column (1) presents various values for the percentage of loss on the original investment if sold (R); Column (2), the required percentage appreciation from current market value when the taxpayer does not take a net loss but simply waits for his investment to regain its cost price; Column (3), the

[9] If the taxpayer has a net short term loss, T in the formula is zero; and the formula becomes

$$R' = R/\{(1-R)(1-T')\}.$$

If the same rate of tax is applicable to both loss and gain, the formula becomes

$$R' = R/(1-R+RT).$$

[10] In the formula, R' is applied to the amount available for investment in the second issue, i.e., the selling price of the first issue plus the tax saving.

corresponding required percentage appreciation (R') on the second investment when a net short term loss is taken on the original investment and a net long term capital gain, subject to a 24.5 per cent tax, is realized on the second. In this case, since there is no tax saving on net short term losses, T is zero. Column (4) presents the corresponding required percentage appreciation (R') when a net long term loss is taken on the first investment and a net long term gain on the second For *long term losses*, the federal minimum alternative tax rate of 16.5 per cent has been used alone, since New York State does not recognize

TABLE II

PERCENTAGE OF APPRECIATION REQUIRED TO RESTORE ORIGINAL CAPITAL UNDER ASSUMED SHORT AND LONG TERM LOSSES WITH LONG TERM GAINS

(When capital loss would be realized on sale of original commitment)

(1) Loss on original commitment	(2) Appreciation required to regain cost by retaining original commitment	(3) Appreciation on new commitment required when $T=0$, $T'=24.5$ per cent	(4) Appreciation on new commitment required when $T=16.5$ per cent, $T'=24.5$ per cent
R	Per cent	R'	R'
10	11.1	14.7	12.1
20	25.0	33.1	26.6
30	42.9	56.8	44.3
40	66.7	88.3	66.4
50	100.0	132.5	94.9
60	150.0	198.7	133.0
70	233.0	309.1	186.3
80	400.0	529.8	259.6
90	900.0	1192.1	400.5
100	Infinite	Infinite	6702.8

net capital losses.[11] Where state income tax laws do recognize such losses, the appropriate rate should be added to the federal rate. For *long term gains*, the federal minimum alternative tax rate of 16.5 per cent and the New York State maximum income tax rate of 8 per cent, i.e. 24.5 per cent,[12] have been used.

Comparison of the percentages in columns (2) and (3) indicates that it is more advantageous, other things being equal, to "sit with a short term loss" rather than take a net short term loss and risk possible recoupment by means of a long term capital gain. Comparison of columns (2) and (4) shows that waiting for recovery of cost values on present holdings is less advantageous than the realization of a long

[11] N. Y. State Personal Income Tax, Section 350, Regulation Article 490.
[12] See footnote (7).

term loss and possible recoupment by a long term gain for values of R greater than 40 per cent. Where state income tax laws recognize net capital losses, all values of R' in column (4) may be less than corresponding percentages in column (2). Comparison of columns (3) and (4) provides a measure, under assumed conditions, of the advantage of waiting until a short term loss becomes a long term loss before effecting sale of the security. To the investment adviser, the table suggests the advantage of careful appraisal of the mathematical consequences of contemplated tax losses.

THE EFFECTS OF DIFFERENCES IN DIVIDENDS AND INTEREST ON REQUIRED APPRECIATION (R′)

The formulae previously developed do not give any consideration to possible differences in dividend or interest income from present holdings of securities and contemplated new purchases. If the investment income is less on the new purchase than on the original holding, one must consider the additional appreciation required to compensate for the difference in investment income. This problem has been studied and it has been determined that the effect on the required appreciation of the new purchase is negligible for all practical purposes.[13]

[13] The table below shows the magnitude of the required additional percentages of appreciation (r') required to compensate for the difference in investment income for a special case. It is assumed that there is a long term capital gain on the original issue, that the rate of tax (T) on the capital gain is 24.5 per cent, that the normal tax, surtax, and super-tax (t) total 40.7 per cent, and that the return on the second commitment is zero. Using the same symbols as employed elsewhere in this study and with D and D' the respective rates of income return on the market value of the original and second commitments, the formula is

$$r' = \frac{[(1+R)(D-D') + RTD'](1-t)}{1+R-RT}$$

Of course when D' is larger than D, the additional percentage appreciation required is negative; but regardless of whether or not it is positive or negative it is so small absolutely as to be of little practical importance in most cases. As indicated above, it has been assumed for purposes of the table that D' is zero. If, however, D' is not zero, the additional appreciation percentages required would be slightly greater than those in the table for the same difference in income return.

Although this table has been constructed for the case in which there is a capital gain on the original issue, the values of r' would be of the same order of magnitude for the case in which there is a capital loss on the original issue.

Annual Percentage of Appreciation (r′) Required on Second Commitment to Compensate for Various Assumed Differences in Income Return

Gain on original issue, R	When difference in rate of income $(D-D')$ is (in per cent): 0.5	1	2	3	4	5
10	0.30	0.61	1.21	1.82	2.43	3.03
30	0.31	0.63	1.26	1.89	2.51	3.14
50	0.32	0.65	1.29	1.94	2.58	3.23
80	0.33	0.67	1.33	2.00	2.66	3.33
100	0.34	0.67	1.35	2.03	2.70	3.38

GENERAL OBSERVATIONS

The formulae here developed are believed to be the first formal attempt to provide a reasonably simple method for mathematical appraisal of the desirability of realizing capital gains and losses under the Revenue Acts of 1938, 1939, and 1940. While the formulae have been treated as though they apply only to the case when one particular security is replaced by another, they are just as applicable in consideration of aggregates of net capital gains and losses. They may also be applied to corporations as well as individuals, if the applicable corporation tax rates are used. No allowance has been made for the carry-over privilege on net short term losses.

Investors and traders, who frequently fail to give the tax problem adequate consideration, should find the formulae most helpful. It is evident that many "trades" would not be undertaken if there were full knowledge of the tax hazards involved; and contrariwise, in many cases the tax hazard frequently is not so formidable as it might at first appear. A seemingly important tax handicap may become, upon analysis, a positive advantage. Investment management may find the implications of the formulae here presented of more than casual interest.

Economists and tax experts may also find the formulae and tables useful in appraising the fiscal wisdom of the tax treatment of capital gains and losses. The elaborate calculations necessary to enable the security holder to treat this problem logically raise the question of the need for more simple laws for the taxation of capital gains and losses.

THE SAMPLING PROCEDURE OF THE 1940 POPULATION CENSUS

By Frederick F. Stephan, W. Edwards Deming, and Morris H. Hansen
Bureau of the Census, Washington

SIMULTANEOUS ENUMERATION AND SAMPLING

A unique combination of complete enumeration and systematic sampling has been introduced into the census procedure in the 1940 population census. It is one of the many developments in methods and organization which were adopted by the Bureau of the Census to overcome the difficulties of enumerating more than 130,000,000 persons within a period of a few weeks, and to obtain as much useful information as possible on important characteristics of the American people.

From decade to decade the public need for population statistics has increased. Largely as a result of the changes wrought by the depression, there is an insistent demand, from both government agencies and the public, for an extensive body of statistical information regarding unemployment, occupational shifts, migration, population growth, and other population changes. Scores of detailed questions were proposed and urged by various organizations for the population schedule of the 1940 census. The schedule had to be limited to the most important of these questions to keep it within the limits of feasibility, but by adding a set of "supplementary questions" to be asked concerning a sample of only one person in twenty, the Bureau of the Census was able to extend the scope of the inquiries and to include a larger number of questions than it could otherwise have done.

The idea of combining sampling with a complete enumeration has interesting possibilities for use in other surveys. Though it is not entirely new, many features of the 1940 procedure are new, and they are described in this article for the benefit of statisticians who will use the data furnished by the sample, or who wish to employ similar sampling procedures for other surveys. It is important to bear in mind throughout this discussion that the sample is taken simultaneously with the regular enumeration and that the two are also closely linked in the subsequent tabulation and analysis.

THE SELECTION OF THE SUPPLEMENTARY QUESTIONS

The supplementary questions were chosen in the same manner as the questions for the complete enumeration except that in addition they were examined for their suitability for sampling. Data on rent, for example, are not suitable since they must be tabulated in some detail by city blocks or other small areas. Data on fertility, on the other

hand, are suitable for sampling, because, in the first place, they are to be tabulated for relatively large areas, and in the second place, the calculations that are made on the detailed classes of the population will be combined to get specific rates that are statistically stable to a satisfactory degree. The supplementary questions chosen to be asked concerning persons in the sample were:

A. Parentage and mother tongue: place of birth of father, place of birth of mother, and mother tongue (language that this person spoke in his home in earliest childhood)
B. Veteran status (Is this person a veteran, the wife, widow, or under-18-year-old child of a veteran?)
C. Social Security (Does this person have a Social Security number? Were deductions made from his earnings during 1939 for Federal Old-age Insurance?—all for persons 14 or over)
D. Usual occupation, industry, and class of worker (for persons 14 or over)
E. Fertility data (for women who are married, widowed, or divorced: Has this woman been married more than once? Age at first marriage, and number of children ever born).

Most of these questions, in one form or another, had been on the schedules for complete enumeration at one or more of the preceding censuses. Their inclusion in the 1940 census, made feasible by the sampling arrangement, provides information concerning both the present situation and the changes that have occurred since earlier censuses. The tabulations of the supplementary information are to be made by large cities, states, major geographic regions, and the United States.

THE PROCEDURE OF ENUMERATION

It was essential that the method of sampling be planned to fit in with established census procedures, for the sample was taken at the same time as the regular enumeration and by the regular enumerators. It was even recorded on the same schedules, in a special space provided at the bottom of each sheet, to avoid handling and matching separate schedules. Furthermore, the data from the sample and from the enumeration are to be related in the tabulations and analysis. A brief description of the enumeration procedure will show more definitely how the regular census work affected the methods of sampling.

The population census is taken by a large corps of more than 100,000 enumerators each of whom is assigned one or more districts to canvass.[1]

[1] An enumeration district is an area assigned to one census taker, called an enumerator. It is solely an administrative unit set up to apportion the work among the enumerators so that none has more territory than he can cover in the time allotted. The usual size of an enumeration district is between 500 and

Each enumerator is given a map of his district and instructed to cover it systematically, enumerating the people who live in the area in the order in which he finds them. Thus, in a city, he is instructed to start at the house on a corner of one block, then take the other houses in order around the block, then start a second block, and so on until he has covered every block in his district. In rural areas he starts down one road, up another, and over the entire road system until he has reached all the households in his territory.

TABLE I

A SIMPLIFIED EXAMPLE OF A PORTION OF THE POPULATION SCHEDULE

(Names and information fictitious)

Sheet 1

	Line No.	Household visitation number	Name	Relationship to head of household	Sex	Color	Age	...
	1	1	Brinster, A. Harold	Head	M	W	38	...
	2		——— Martha	Wife	F	W	35	...
	3		——— Robert H.	Son	M	W	11	...
	4		——— Devorah	Daughter	F	W	9	...
	5	2	Arnlon, J. Peter	Head	M	W	53	...
	6		——— Elizabeth	Wife	F	W	49	...
	...		...	...	...	...	...	...
	13	5	Ronsston, Stevens W.	Head	M	W	46	...
Sample line	14		——— Anna	Wife	F	W	44	...
	15		——— John	Son	M	W	13	...
	...		...	...	...	...	...	...

(At the bottom of each side, the supplementary information is written for the two persons in the sample, in this instance Anna Ronsston and the person enumerated on line 29.)

Each enumerator is supplied with a set of schedule forms for recording the answers to questions about people, farms, houses and related subjects. The form for the population enumeration is a "line schedule" with 40 lines on the front and 40 on the back. A separate line is used for each person enumerated; on it are recorded his name and the answers

1,500 people, though some run to extremes of 3,000 or more, or down as low as 25 or 50, or even to a single person. An extremely small enumeration district is usually brought into existence by the requirement that it must not overlap an adjacent boundary such as a city, county, township, or Congressional District line. Small enumeration districts are usually assigned to an enumerator having a larger district nearby, with the consequence that there are more enumeration districts than enumerators. As a matter of fact in the 1940 census there were 154,000 enumeration districts, but only about 110,000 enumerators.

to the questions concerning him. The members of a household are listed in order on consecutive lines; the members of the next household enumerated are listed on the lines immediately following. Occasionally a line is used for a note of explanation, such as, "Here ends block 56 and begins block 57" or "Here ends the enumeration of Tompkinsville which is unincorporated." Table I shows in simplified form the way in which the listing proceeds.

An enumerator may fill 20 or 25 of these schedules if his district contains as many as 1,500 or 2,000 persons. In very small districts he may need only one or two.

The enumerators are employed for only a few weeks, and for the most part they have had no special training for the work other than a short course of instruction given by their supervisors. In addition to the population census they were responsible in 1940 for simultaneous work on the housing census, and in rural districts for the agricultural census also. Some of the questions in these inquiries are complicated, and as a consequence the enumerator was required to master an elaborate body of instructions and definitions.

It is well recognized that in taking a sample, the employment of expert enumerators is particularly advisable. It might have been possible to give special training to a few thousand enumerators, but not to all. Now one requirement imposed on the 1940 sampling procedure was that the sample and the regular census be taken simultaneously, wherefore there was no possibility of taking the sample by following up the regular enumeration with revisits to those persons or households that had been selected for the sample—in particular, revisits by specially trained enumerators. The possibility of using specially trained enumerators for whole sample enumeration districts was still left open, but as will be seen later, the enumeration district is hardly the best unit of sampling.

In view of these facts it was recognized that the sampling procedure, so far as the enumerator is concerned, must be simple and quite automatic in its operation. It should not leave anything to the discretion of the enumerator. It should not impose any complicated regulations, or burden his memory with special rules: as he proceeds with the enumeration, the forms that he uses should be so designed that they remind him whenever he should ask the supplementary questions. The sampling procedure must produce good results even though some families and individuals are enumerated out of their natural order, as will happen when a family is inaccessible at the enumerator's first visit. It should work well even for large institutions such as orphanages and old people's homes. It should require little if any change in well established

census procedures. Finally, to save time and expense, it must not introduce too many complications in the printing and distribution of the schedules.

These conditions were not found to be unduly restrictive. They did make it impracticable to adopt certain ideal methods of random sampling that otherwise might have been employed. Any actual sampling, however, must always be a compromise forced by administrative limitations.

THE METHOD OF SAMPLING

The sample was selected by printing the schedules with notes in the margins that designated 2 of the 40 lines on each side as the sample lines, and instructing the enumerators to ask the supplementary questions, in addition to the regular questions, for each person whose name happened to fall on these lines. In this way a sample of 2 out of 40, or 5 per cent, was obtained, a proportion large enough to yield a satisfactory degree of stability in the tabulations that were contemplated and small enough to keep the cost of the sample within what were regarded as reasonable limits.

This method of sampling selected exactly 5 per cent of all lines in each geographic area and in this respect it was "stratified" or "controlled" for geographic differences in population characteristics. Apart from the usual variations due to chance, it selected 5 per cent of each recognizable kind of persons such as, for example, men 40 to 44 years of age who were carpenters and who were working at the time of the census. It also selected, of course, 5 per cent of the lines left blank or filled with notes of explanation, but these do not figure in the tabulations or create any difficulties. The actual percentage of any class of persons drawn for the sample from any district varies by chance in the usual way depending on how the names happen to line up as the enumerator proceeds around his district.

Several other methods of sampling were investigated carefully before this method was chosen. The selection of a sample of entire states, counties, cities or even somewhat smaller geographic areas does not yield stable or satisfactory results for the purposes that this sample must serve. The selection of a sample of enumeration districts was thought to have several definite advantages to recommend it. It simplifies certain administrative problems. The sample districts can be assigned to a small group of enumerators specially selected and trained for this purpose. The work of enumerating the sample population is not complicated by the distinction between the persons or households that are in the sample and those that are not, because the entire population of every sample enumeration district is in the sample. Another advan-

tage of using the enumeration district as a sampling unit is that the sample can then be given priority in the coding and tabulating processes, and the sample returns thus completed much earlier than is possible by the use of still smaller sampling units. The reason is that the processing and tabulating of the census data in the Washington office are necessarily carried out on the basis of the enumeration district.

These advantages, however, do not justify the choice of the enumeration district if a feasible scheme can be drafted for sampling by the individual person or household. The latter are to be preferred for they have been shown by several studies to have much greater sampling efficiency[2]; although accompanying this increased efficiency comes a host of additional administrative problems.

Random sampling of households or persons within each enumeration district would be an ideal method if a good scheme could be found for drawing such samples. If the enumerators are asked to select the sample by chance, they may introduce serious biases by deliberately or unconsciously departing from the correct procedure. Moreover, this method of selection would add materially to the burden of their work. If the sample is to be selected at random by the supervisors or the central office, the cost of preparing the lists would be prohibitive.

After these and other possible methods had been investigated, it appeared that a scheme of sampling at designated intervals was required. The choice appeared to lie between taking every twentieth person and taking every twentieth household. A comparison of these two units of sampling in relation to the nature of the supplementary questions and the contemplated tabulations made it appear likely that for most purposes they would be about equal in efficiency, but otherwise the individual or, strictly speaking, the schedule line, should be preferred.

From the standpoint of the enumerators' interviews there is little choice between the individual person or line, and the household. The line unit certainly fits better into the established census procedures, and permits simpler and more definite instructions to the enumerator on whom to include in the sample. It also facilitates control of certain disturbing influences that are discussed further on, and it simplifies the theoretical calculations of the sampling fluctuations. After a study of the relative advantages of the two units, and some experimental trials, the individual person (schedule line) was chosen as the sampling unit in the 1940 population census.

[2] By the relative efficiency of two units of sampling is meant the ratio of the number of persons needed in samples taken by the first kind of unit to the number of persons needed in samples taken by the second kind of unit to attain the same degree of stability (the same standard error), the sampling methods being identical in all other respects.

BIASES OF SYSTEMATIC SAMPLING

Any estimate made from the sample will vary with the set of lines that is used as sampling lines, and the problem is to choose them in such a way that the sample will contain, as nearly as possible, the same proportions of heads, wives, heads of corner houses, male children 19 years of age, blanks, notes of explanation, etc., as are found in the entire population of the lines that are turned in on the schedules of the enumerators for a given area of tabulation (state, city, or the U. S.).

If samples are drawn by taking every person enumerated on some one designated line, the sample may show a persistent tendency either to overstate or understate the frequency of certain characteristics and their proportions in the population. For the census sampling, this bias of samples based on one selected line, or set of lines, will be referred to as "line bias." It is entirely distinct in its origin from statistical fluctuations, which are due solely to chance, although in any given sample the effects of line bias and statistical fluctuations are always combined. The combined effect of line bias and statistical fluctuations is what must be minimized. These two kinds of errors in sampling may be outlined as follows:

I. Line bias arising from systematic sampling
   (a) Process biases, arising from a systematic procedure specifying the order of enumeration (i) within blocks, and (ii) within households.
   (b) Enumerators' biases, arising from the failure of enumerators to follow instructions.
   (c) Enumerators' tendencies to cover their territories in certain patterns.

II. Statistical fluctuations

   For any sampled area, consisting of a large number of enumeration districts, the distribution curve of any population characteristic plotted against line number will vary with a re-enumeration owing to the fact that (a) new enumerators will by chance choose a new set of routes in covering their territories, thus listing people in a different order; (b) and even along any given route, the order of enumeration depends on what people happen to be at home on the enumerator's first visit. A multiplicity of other small causes affects the order of enumeration and hence the characteristics of the persons enumerated on any specified set of lines. The composite effect of these causes of variation we may call "chance."

We can not wholly eliminate or even control the statistical fluctuations, but we can keep their average magnitude within any desired limits by refraining from cross-tabulating the sample to a point where it gets too thin.

The line biases can be eliminated, but the simpler methods of doing this are not always practical. They arise from the fact that, sample or no sample, an enumerator must make a systematic coverage; he must

TABLE II

HYPOTHETICAL ENUMERATION OF A CITY WITH 94 ENUMERATION DISTRICTS SHOWING CHARACTERISTICS* BY SHEET AND LINE NUMBER

Sheets between the second and last are not shown

Line no.	First sheet in district:						Second sheet in district:						Last sheet in district:						Totals for all sheets				
	1	2	3...92	93	94		1	2	3...92	93	94		1	2	3...92	93	94		H	W	C	O	B
1	H	H	H...H	H	H		W	H	O...C	C	C		C	H	C...W	O	C		327	208	378	87	0
2	W	W	W...W	W	W		C	W	O...C	C	H		O	W	C...C	O	C		231	305	384	80	0
3	C	H	C...C	C	C		C	C	H...C	O	W		H	C	C...C	O	H		252	215	442	90	1
4	C	W	C...H	H	C		O	C	W...C	O	H		W	C	H...O	H	W		256	227	426	88	3
5	C	C	H...W	W	H		H	H	C...O	B	W		C	C	W...H	C	C		249	229	431	85	6
6	O	H	W...C	C	W		W	C	C...O	H	C		H	C	C...W	C	C		254	220	438	81	7
7	H	O	O...C	H	C		C	C	C...H	W	C		W	H	C...C	B	C		259	223	432	77	9
8	W	O	H...H	W	O		H	O	C...W	C	C		O	W	C...C	B	H		257	230	420	83	10
...			...						...						...						...		
75	C	W	C...C	C	C		C	C	C...C	H	C		B	C	O...B	B	B		231	208	397	71	93
76	O	C	H...C	C	O		B	B	H...C	W	C		B	H	O...B	B	B		238	205	395	69	93
77	H	C	W...C	C	O		H	B	W...H	C	C		B	W	B...B	B	B		233	212	395	64	96
78	W	C	C...C	H	O		W	B	C...O	C	H		B	B	B...B	B	B		229	209	392	73	97
79	C	B	C...H	W	H		C	B	H...O	O	W		B	B	B...B	B	B		235	202	398	67	98
80	H	B	C...W	C	W		C	B	W...O	H	C		B	B	B...B	B	B		227	211	391	73	98

* The symbols represent the following:

H Head of household
W Wife of head
C Child of head
O Other member of household
B Line left blank

commence at a corner house and work around the block, listing households in the order in which he finds them at home. Moreover, within a household, the members must be listed systematically—head, wife, children in order of age, other relatives, lodgers, and their children, servants, and their children. All this is in accordance with long established census procedure. The inevitable results are undulatory. Corner houses are different from other houses; studies conducted on "corner influence" show that household characteristics, such as rent, value of home, number of children, number of lodgers, vary from house to house in waves of distinct patterns with peaks or depressions at the corners. It is easy to find single blocks that do not fit into the pattern, but the mass effect is found to exist with remarkable regularity in city after city. Moreover, within a household, personal characteristics, such as

sex, age, education, employment status, income, vary from one member to another, and thus the specified order of enumeration produces a pattern of waves on any one schedule; hence any combination of schedules, line by line, will show similar waves to the extent that the several schedules fluctuate in phase.

The nature of line bias may be understood from a study of Table II. Each of the 94 enumerators starts with a head of a household on line 1 of his first schedule. Almost all of them list a wife on the second line and most of them list a child on the third line. In the second district, however, the first family consisted of only two persons and consequently the head of the second family appears on line 3. If all families were of the same size, say 4 persons each, certain other lines would be like line 1 in having only heads recorded on them, but because families vary in size, the waves get out of phase and the tendency of lines to show an undue proportion of one kind of person quickly dies away. It is as if the population were "shuffled" for the later lines.

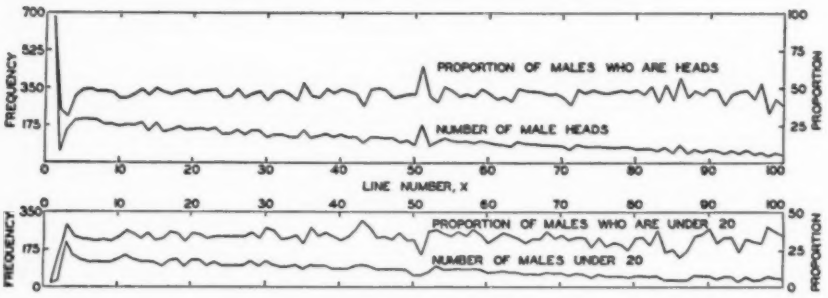
If every sheet started with a new family, all the individuals on line 1 would be heads. When this is the case a sample that includes lines 1, 21, 41, and 61 will greatly overstate the number of heads, and a sample that consistently excludes line 1 will understate the number of heads. Similarly, one that consistently includes line 2 will overstate the number of married women.

In the 1940 census the enumerators were instructed to fill every line on a schedule before starting a new one. This reduces the bias of line 1, since the later schedules will not then start with heads except by accident; but of course the bias is not thereby eliminated entirely; it is still present on line 1 of the enumerators' first schedules. As was anticipated, some enumerators started new pages on their schedules when there were not enough lines left at the bottom of the preceding page to list the entire family next to be enumerated; in fact, contrary to instructions, this happened on 3½ per cent of the pages. The enumerator in the second district in Table II disobeyed instructions in this way, apparently being loath to divide a family between one sheet and the next. In earlier censuses instructions were indefinite concerning whether families should be carried over, but this year it was a matter of some importance. A similar phenomenon occurs, but to a lesser extent, at the middle of a schedule, because some enumerators try to avoid listing part of a household on one side and part on the other side. The chart illustrates the effect of starting most of the sheets with a new family and also the corresponding effect in the middle lines.

The existence of a line bias or regression on line number can be demonstrated for many population characteristics. The amount of bias

can not be estimated very well in advance and consequently it is usually difficult, if not impossible, to make allowance for it. However, it is possible to select sets of sampling lines such that the biases of some of them offset completely, or very nearly so, the biases of the others, whatever these biases may be. Such sets will be referred to as "unbiased sets."

LINE BIAS AND SAMPLING FLUCTUATIONS



TOP: Male heads of households enumerated on line x, in a portion of South Bend: 1939. BOTTOM: Males under 20 enumerated on line x, in a portion of South Bend: 1939. In this census the enumerators always commenced a new block, and often a new family, on a new side of the sheet (lines 1 or 51 on the 100 line schedule); this procedure causes fluctuations of great intensity in the earliest lines, and of secondary intensity in the middle. The ripples lying between line 6 and the middle, and again between line 56 and the end lines, are primarily attributable to statistical fluctuations, which are prominent here because the sampled population is small—smaller than would be used in a published tabulation.

BALANCING BIASES BY VARYING THE SCHEDULES

One method of balancing line biases is to have each line number appear in the sample with equal frequency. This could be done, for example, by printing twenty kinds of schedules, the first marked for sampling lines 1, 21, 41, 61, the second for lines 2, 22, 42, 62, and so on to the twentieth, marked for lines 20, 40, 60, and 80. These styles of schedules would then be arranged in varying orders so that enumerators would not all start with the same style, or each enumerator would be given only one style, and the styles would be assigned to the enumerators in rotation so that the same number of districts or of persons would be enumerated on each style in any city, county, or state.

It was not considered feasible to print so many different styles of schedules and distribute them in the manner that would be necessary. Moreover, there was reason to believe that the styles starting with lines 9 or 10 would yield results that differ very little, if at all, from those starting with lines 11 or 12, and hence the question arose concerning whether a smaller number of styles would not do equally well. It was thought that five would be sufficient: four (styles *W*, *X*, *Y*, *Z*) appeared adequate to sample proportionately each of the lines

that are affected most violently by line bias; the remaining one (style *V*) appeared adequate to obtain a sample representative of all the remaining lines. Accordingly, as is seen in Table III, lines 1–6, 39, 40, 41, 42, 44, 46, 75, 77, 79, 80, were assigned to the *W*, *X*, *Y*, *Z* styles, each of which was used in 1 enumeration district out of 20, thus giving each of these critical 16 lines its correct 1 in 20 representation. It will be observed that the lines on the backs of the schedules on these four styles were spaced out a bit to catch oscillations in the regressions that might appear more than four lines from the top or bottom of the page. This will be accomplished, of course, only in part, but it was felt to be better to balance them only in part rather than run the risk of missing them entirely in some instances. There is left the problem of sampling the remaining 64 lines by the *V* style schedule which was used in 16 out of 20 enumeration districts. It is this that we proceed now to discuss.

BALANCING BIASES BY THE METHOD OF SELECTING AN UNBIASED SET OF LINES

If a schedule style is to be free from bias, the set of sample lines thereon must be so selected that the sum of their biases is zero; or, in other words, so that for a sampled area the expected value of the average, or proportion, for any given population characteristic calculated from these lines is equal to the average, or proportion, that would be obtained from all the lines on the schedules for that area. Since usually the amount of bias for any characteristic is not known, it is not possible to examine the lines and match up an unbiased set of them. Furthermore, if they were matched for one characteristic, they would not usually be matched for another. Hence generalized matching of biases is necessary.

In a general way the sources of the line biases are known, and are as described two sections back. Except for the earliest lines, where the oscillations arising from the starting point are pronounced, and except also for the lines in the middle and end of the schedule where there are secondary oscillations arising from the failure of some enumerators to carry families over, the regression of any characteristic on line number, save for variations due to chance, is a smooth curve. This is to be expected, for variation in the size of households quickly damps out the more violent oscillations exhibited by the first few lines. This was spoken of earlier as a shuffling in the later lines of an enumeration. The exact shape of the regression against line number depends, of course, on the characteristic being studied, but in any event is affected by the varying sizes of the enumeration districts within the sampled area, i.e., by the proportion of all sheets filled to the last line, or, in

general to the ith line, or the proportion of blanks for each line.

Ordinarily, the smooth part of the regression can be approximated by an equation of the form

$$y = p + qx + rx^2 + sx^3 \tag{1}$$

where y is the proportion or average of the population characteristics on line x. p, q, r, and s are constants or parameters, peculiar to the characteristics being studied and the particular area being sampled. Equations of other degree might be used or required, but in general, the degree of the equation should not exceed the number of sampling lines available.

In this particular work, with four sampling lines available, a quartic term could be added to the cubic, whereupon the four sample line numbers would be unique. As a matter of fact, the four line numbers finally selected for the V style (Table III) do very nearly satisfy the four equations that would result from the quartic. For reasons that will appear later, however, we wish to fix one line (line a) on other considerations, and then to determine the other three lines as companions to it. We therefore continue with the cubic, and seek four values of x (that is, four line values for the V style) such that whatever be its shape, the expected value of the average of the characteristics or values of y for the four selected line numbers will be equal or nearly equal to the average for the entire 64 lines that are being represented by style V.

Let $\sum$ denote summation over the n lines that are to be sampled. Assume that a set of four sampling lines will be selected. Designate the values of x for these lines by the letters a, b, c, d; then the average of the four values of y of the cubic for these values of x will be

$$\tfrac{1}{4}[4p + q(a + b + c + d) + r(a^2 + b^2 + c^2 + d^2) + s(a^3 + b^3 + c^3 + d^3)] \tag{2}$$

The average of the n values of y is

$$(1/n)\ \sum(p + qx + rx^2 + sx^3) = (1/n)(pn + q\sum x + r\sum x^2 + s\sum x^3) \tag{3}$$

These two averages will be equal, whatever be p, q, r, and s (i.e. whatever be the shape of the cubic) if the coefficients of the parameters are respectively equal, i.e. if

$$\left.\begin{aligned} \tfrac{1}{4}(a + b + c + d) &= (1/n)\textstyle\sum x \\ \tfrac{1}{4}(a^2 + b^2 + c^2 + d^2) &= (1/n)\textstyle\sum x^2 \\ \tfrac{1}{4}(a^3 + b^3 + c^3 + d^3) &= (1/n)\textstyle\sum x^3 \end{aligned}\right\} \tag{4}$$

These are three equations for the four unknowns a, b, c, d. A fourth equation may be written if the quartic term is added to (1).

Before proceeding with a numerical solution for this application of the method it is necessary to fix line a. Calculations based on corner influence, and on tables exhibiting the median rents, and the proportions of heads, wives, etc. of the 1st, 2d, 3d, etc. family, that would fall on the enumerators' first 20 lines, showed that the oscillations in the earliest lines persist beyond line 6. It was found that by putting $a=14$, the V style will give a good average value for the population beyond line 6 for characteristics such as the ones just mentioned. The other three sampling lines b, c, d, are found from the above three equations, with $n=64$, after a has been set equal to 14. It is of mathematical interest to note that the three equations, being symmetrical, reduce to a single equation of third degree whose three roots, for any assigned value of a, are b, c, d. Since the sampling lines can not be fractional, we do not take the exact solution, but rather the best approximation with integers, with due regard for a reasonable spacing between the sampling lines. Those finally selected are

$$a = 14 \text{ (given)}, b = 29, c = 55, d = 68 \qquad (5)$$

These values satisfy the first two of equations (4) exactly, and the third very nearly. They are the unbiased set of lines shown for style V in Table III. The five styles, used in the correct proportions (16:1:1:1:1), should give a sample that is very nearly free from line biases.

TABLE III
THE SAMPLING LINE NUMBERS AND THEIR PROPORTIONS

Style	Proportion	Line numbers			
V	16	14	29	55	68
W	1	1	5	41	75
X	1	2	6	42	77
Y	1	3	39	44	79
Z	1	4	40	46	80

THE DISTRIBUTION OF THE SCHEDULES

The presumption is that the W, X, Y, and Z styles will each be used for 1/20th of the population in any sampled area, and the V style for the remaining 16/20ths. It is assumed moreover that the several styles of schedules will be well dispersed within any sampled area. The best plan seemed to be to provide each enumerator with one style of schedule only, and to maintain 16:1:1:1:1 ratios by enumeration districts. Thus, in a county of 20 enumeration districts, 16 enumerators

would use style *V*, one would use style *W*, one *X*, one *Y*, and one *Z*. Of course, unless the populations of these 20 enumeration districts were all equal, the 16:1:1:1:1 ratios would not be maintained by population. However, because of the shuffling of the population (vide supra), it is only necessary that each enumerator start with the style assigned to him; the rest of the population will be sampled without bias on any of the five styles.

The effect of extremely small enumeration districts is ironed out for the reason that sample tabulations are made only for areas containing hundreds of enumeration districts, wherefore the regression on line number is pretty well taken care of by the cubic.

The actual plan of distribution was to assign the style letters to the enumeration districts by the following rotation scheme: *V V W V V V V X V V V V Y V V V V Z V V*, repeated over and over, county after county, without any break at county nor state lines. Thus, the required ratios were approached to a high degree of refinement over any sampled population large enough to be considered eligible for tabulation.

EDITING THE SAMPLE

In any enterprise as large as the population census, it is inevitable that some mistakes will be made and require some sort of editing or adjusting in the Washington office. Most of this editing is very simple, but some of it requires careful study of the enumerators' difficulties. A few enumerators included persons in the sample who had been enumerated on lines other than those that were designated as sample lines. In most instances, the supplementary information for these persons was deleted in the editing, though in many cases the enumerators' blunders were such as would cause very little bias, if any, and were allowed to stand. Occasionally the information on the supplementary questions was not recorded for a person enumerated on one of the sample lines. The losses to the sample tabulations resulting from these omissions and cancellations are none at all on the main-schedule items, and less than 1 per cent of the sample on the supplementary items. Apart from these infrequent mistakes the sampling procedure was followed faithfully. A tally of the changes that were made in the editing process will be helpful in removing the bias in the tabulations of the supplementary items, occasioned by the enumerators' mistakes.

THE USE OF REGULAR CENSUS DATA TO IMPROVE THE SAMPLE

In the absence of any information from the complete enumeration of the population, the best procedure for obtaining estimates for the

number of persons in a particular class is to multiply by 20 (the sampling ratio) the count of that class in the sample. But sometimes a tabulation that is made from the complete count is very helpful. Thus, for simplicity, consider the two sub-classes A and B. Suppose that they are sampled, and moreover that the complete count gives $A+B$ but not A nor B separately because A and B were not distinguished on the main schedule or else were tabulated only in combination as one class. Here the complete count furnishes a check on the sum of the estimates of A and B, for whatever numbers are estimated for A and B from the sample, their sum should be the known value $A+B$. Without the complete count, A and B would be estimated by multiplying by 20 the numbers in the corresponding cells of the sample. With the complete count, however, the sample may be strengthened considerably; it then only needs to furnish the ratio $A:B$ or $A:(A+B)$, and this it often does with greater relative precision than A or B separately. When the complete count of some class is known, and an estimate is to be made for some subclass thereof, one simply multiplies the known count by the proportion observed in the sample.

For some tabulations it is possible to use more than one class count from the complete enumeration, thereby improving still further the accuracy of the adjusted sample tabulations. This subject is pursued in a separate paper by the authors[3]; in it a simple iterative procedure is devised for accomplishing the adjustments of sample data when certain class totals are known.

A WORD ON SAMPLING

In this paper the authors have considered the problem of devising a method of sampling in a census that will yield results that agree very closely with the results that would be obtained from the tabulations from a complete count. In a later article they will treat the subject of sampling from another standpoint, emphasizing the fact that for scientific purposes, a "complete enumeration" is itself but a sample. Even a "perfect" 100 per cent sample (complete count) is but one of the many perfect yet distinct 100 per cent samples that might have resulted from the same social and economic cause systems existing at the time of the census. Even with unlimited funds for cross-tabulation, there is a limit to the usefulness, not only of the sample data, but also of a complete census. This implies that except when a census is by definition merely an inventory, small numbers in the cells of a table,

[3] W. Edwards Deming and Frederick F. Stephan "On a least squares adjustment of a sampled frequency table when the expected marginal totals are known," *Annals of Mathematical Statistics*, XI (Dec. 1940).

even when derived from a complete tabulation, have no more significance than they would if they were derived from a sample.

Certain aspects of sampling a population that have necessarily been omitted or abbreviated here will be discussed more fully in a technical bulletin to be issued by the Bureau of the Census. Among other things this bulletin will emphasize the advantages that flow from having a representative sample of the population, small enough to be processed quickly and at low cost. Specifically, the sample makes it possible to (i) carry more questions on the schedule, (ii) complete sample tabulations of many population characteristics months ahead of the regular tabulations derived from the full count—an especially important feature in times of national emergency, (iii) cross-tabulate in more detail for large areas than would be feasible on the basis of the full count, because of the expense, and (iv) store the various punch cards of the sample so that they may be used later on, as the need arises, for extracting information still latent in them.

ACKNOWLEDGMENT

In conclusion, it is fitting to remind the reader that a number of people participated in the planning of the sampling procedure of the census, and that the subject pursued in this paper is only one phase of the sampling program. Throughout the conduct of the research here reported, the leadership of Drs. Leon E. Truesdell and Philip M. Hauser, respectively Chief Statistician and Assistant Chief Statistician for Population in the Bureau of the Census, has been indispensable. Consultations with Dr. Calvert L. Dedrick and Professor Samuel A. Stouffer were especially helpful in the initial planning of the work. Numerous difficult statistical calculations on corner influence and line number were carried out for the authors by Miss Irma D. Friedman.

ON MEASURING THE COST OF LIFE INSURANCE

By Thomas S. Berry
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For the past ten years the question of the cost of American life insurance has repeatedly come to the fore due to a continued lowering of dividends by the companies, the agitation for social security legislation, and the proposed extension of savings bank life insurance. Furthermore, most life insurance companies have raised premium rates and surrender charges, thus providing a signal for further controversy. More recently, the Temporary National Economic Committee has rendered a report on life insurance which provides an excellent basis for future discussion.[1] Here we shall consider only the problem of measuring the cost of ordinary (as opposed to group and industrial) insurance.

The premium rate on non-participating term insurance has in the past been the most accurate index of cost available. There are no dividends nor cash surrender values to complicate the situation. The rate is guaranteed and therefore significant whether quoted as to past, present, or future. The annual premium on twenty-year term at age 35, which has long been approximately $10 per thousand, has been increasing since the depression. However, this quotation is rarely used (the TNEC inquiry, for instance, hardly mentions term insurance). Little term insurance is sold; and there is no guaranty that a term rate is typical of other policies.[2]

Current confusion over the cost of the popular ordinary or straight life insurance policy is largely due to the fact that the latter is a hybrid between expense and investment. Company expenditures out of premium income cover such items as operating expenses and death claims; on the other hand, reserves are accumulated which are not unlike savings deposits. These reserves, with accumulating interest, make it possible to maintain the insurance at a level premium throughout the lives of the policyholders.[3] Whereas the layman thinks of his annual premium (less dividend if the policy is participating), the expert fig-

[1] *Investigation of Concentration of Economic Power: Hearings before the Temporary National Economic Committee . . . Part 10: Life Insurance. Intercompany Agreements; Terminations; Savings Bank Insurance; Legislative Activities* (Washington, 1940. pp. xvii, 4153–4932, xxx). *Part 10-A: Life Insurance. Operating Results and Investments of the Twenty-six Largest Legal Reserve Life Insurance Companies Domiciled in the United States, 1929–1938* (Washington, 1940. pp. xiv, 323).

[2] For participating term, allowance need be made only for dividends (deductible from the premiums) to ascertain the cost. Term insurance may be used as a "loss leader;" but there is reason to believe that the premium is "loaded" for expenses to a full extent because the companies have little opportunity to earn interest on policyholders' funds. See *Hearings* (*op. cit.*) Pt. X, p. 4721.

[3] The cash surrender value is the reserve less a surrender charge. The latter is usually graduated downward according to the age of the policy.

ures the cost of protection by subtracting the accumulated equity (cash surrender value) from the total premiums. The annual premium at age 35 (less dividend) is about twenty dollars per thousand, or approximately twice the term rate quoted above. On the other hand, the expert's "net cost" averages annually only about three dollars per thousand, depending upon the company, for policies at the same age surrendered twenty years after the date of issue.

The "net cost" is simply a difference between all sums paid to the company and the amount returnable at the expiration of a given period. It may be computed for all forms of contracts, whether participating or non-participating (in case of the latter, no allowance need be made for dividends); it may be a résumé of past experience ("actual history") or a forecast according to the current premium, dividend scale, and cash value ("prospective"). Whatever the case, the "net cost" is a gross understatement of the cost of protection because it makes no allowance for (1) interest foregone in an alternative investment and (2) protection lost because of an increase in the reserve.

Lack of space prevents extended discussion of the second item. Stated baldly, the gain to an estate at death is not the face value of the insurance policy but only the difference between it and the cash surrender value.[4] In term insurance the "amount at risk" (in actuarial parlance) is equal to the face value because there is practically no surrender value. But the true protection decreases rapidly in the higher-premium forms (approaching zero in the case of endowments). Strictly, we can ascertain the amount of protection only by comparing the face of an insurance policy with the value of an alternative investment at the same point of time. Annual averages are not too significant since the latter accumulates at compound interest, and mortality changes from year to year. However, it can be shown that for the period 1919–39 the death benefit to a $1,000 ordinary life contract issued at age 35 exceeded a savings deposit by an average amount of approximately $830.[5] In other words, any cost figure for this type of policy should be divided by 83 per cent to arrive at a figure applicable to $1,000 insurance.

The neglect of the first item above—loss of interest in an alternative investment—has led to curious results in "net cost" comparisons. In some companies the cost of ordinary life issued at age 35 has averaged

[4] For a careful explanation of this point see the *Hearings*, Pt. 10, pp. 4286 *ff*. According to some contracts the surrender value is available only on the anniversary of the policy. This provision protects the company against sudden large withdrawals.

[5] Corresponding figures for the twenty-payment life and twenty-year endowment are $690 and $480, respectively.

$7–8 a year over a twenty-year period; yet there are instances where it has been a minus quantity. Twenty-payment life contracts commonly have a negative net cost, as do practically all the twenty-year endowments. Such a "net return to the policy-holder" suggests that the survivor received his protection free—or rather profited by taking it out. According to this procedure, one could figure the cost of a $1,000 bond at $600 since ten $40 coupons have been redeemed. Perhaps a better analogy is furnished in the following case. In the course of a bank liquidation a depositor whose account shows 20 annual deposits of $25 each is paid a final dividend of $525. Hence, the liquidation brought him $25 gain since he was repaid the sum total of his original deposits and $25 besides.

A few writers have called attention to this situation; but no satisfactory plan to allow for foregone interest has been advanced. One proposal—to accumulate premiums at 6 per cent—yields exaggerated cost figures since no investment with that yield has been found to duplicate the safety and general availability of American life insurance. Some authorities, on the other hand, have emphasized the investment phase to the exclusion of the insurance. Thus it is shown that to ascertain the return on the investment it is necessary to abstract from the cost of protection.[6] This approach, intended to be realistic, helps to explain the anomaly that few have seen fit to ascertain the cost of the insurance element in life insurance by abstracting from the return on the investment element.[7]

If allowance is made for interest foregone in a "prospective net cost," both future dividends (on participating policies) and a future interest rate on alternative investment must be assumed. This is the procedure adopted by the TNEC staff in its elaborate study,[8] primarily to make it possible to compare costs on different types of policies.[9] This involves the discount of all premiums, dividends (1939 scale), and future cash values to present equivalents at the rate of 3½ per cent. Such a method gives results more sensitive to the current situation. However, "actual history" figures are generally to be preferred since they correspond to

[6] See S. S. Huebner and David McCahan, *Life Insurance as Investment* (New York, 1933. pp. xix, 291), 78 *et passim*. The analysis was entirely prospective and employed the now obsolete 1931 dividend scales.

[7] See, for instance, Edward Berman, *The Massachusetts System of Savings-Bank Life Insurance*. U. S. Bureau of Labor Statistics, Bulletin No. 615, p. 87 *ff*.

[8] *Hearings*, Pt. 10-A, pp. 300–14.

[9] *Ibid.*, pp. 282–83. It is noted that crude net costs are lower for participating than for nonparticipating policies, for high-premium than for low-premium forms of insurance, and for policies with deferred dividends as compared with contracts in which the dividends increase at a steady rate. In each case earnings on policyholders' funds are responsible for the bias.

facts rather than prognostications; furthermore, they are not dominated by the experience of one or two years.

As opposed to the TNEC "discounted net cost," we propose a "cumulated net cost," in which all past payments are accumulated according to the dividend rate of a large, reliable savings bank.[10] For the period 1914–34 this rate was equivalent to an average of approximately 4¼ per cent; for the interval 1919–39 it was 3½ per cent; but for the ten-year interval 1929–39 it declined to only 2¾ per cent. The savings bank rate was very nearly equivalent to that paid by life insurance companies (on accumulating funds) until 1932, when a spread began to develop which has persisted at almost 1½ per cent for the past two years.[11] If the savings bank rate is considered low for the purpose, the cost results may be treated as minima.

TABLE I

CALCULATION OF TWENTY-YEAR CRUDE "ACTUAL HISTORY" NET COST AND "CUMULATED NET COST," 1919–39

Calculation of Crude "Prospective" Net Cost and "Discounted Net Cost" with 1939 Dividend Scale. Ordinary Life Policy. Age at Issue, 35.

	Actual History Net Cost 1919–39	Cumulated Net Cost 1919–39	Prospective Net Cost 1939	Discounted Net Cost 1939
Premiums totaled	$527.00	$772.62	$527.00	$387.60
Less dividends	134.55	184.57	107.75	74.04
Total net premiums	392.45	588.05	419.25	313.56
Less cash value (1939)	327.58	327.58	(1959) 327.58	164.63
Net surrender cost to survivor	64.87	260.47	91.67	148.93
Annual equivalent	$ 3.24	$ 8.88	$ 4.58	$ 10.12

Source: Temporary National Economic Committee Hearings, Part 10-A, pp. 286–302. Fliteraft Compend, 1939. Massachusetts Mutual.

In Table I we present four twenty-year cost exhibits for a leading company, all pertaining to the ordinary life contract issued at age 35 as reported in 1939. Reduction to an annual basis makes comparison possible. The crude "actual history" net cost may be compared with the "cumulated," the crude "prospective," or the "discounted."[12] The

[10] The Provident Institution for Savings in the Town of Boston. On savings bank and insurance investment requirements see the *Hearings*, Pt. 9, 3805 (Washington, 1940. pp. xii, 3493–4151, vii); Pt. 10, p. 4476.

[11] Comparison is made with the Metropolitan Life Insurance Company. The insurance rate has been 3½%, a guaranteed minimum; and the savings bank rate has been 1% semi-annually since July, 1938.

[12] The TNEC figures were summarized as lump sums which make comparison impossible. In Table I the aggregate present value ($148.93) is reduced to an annuity by a coefficient (14.7098) which represents the present value of an annuity. Similarly, the aggregate cumulated value ($260.47) is reduced

interest item is considerable in such a long interval of time. For the past figures it averages $5.64 annually ($8.88 less $3.24); for the future, $5.54 annually ($10.12 less $4.58).

In Table II summary figures are presented which extend the procedure of Table I to the 26 leading American companies. Historical data for the period 1914–34 are also included. All annual figures are

TABLE II

COMPARISON OF NET COSTS, 1914–1939

Weighted Averages of the Annual "Actual History" Net Costs and Cumulated Net Costs of Ordinary Life Insurance, Age 35, in 26 Leading American Companies over the Periods 1914–34 and 1919–39. Weighted Averages of the Prospective Net Costs and Discounted Net Costs for Similar Policies issued in 1939 and Surrendered 20 Years Later.

	Actual History Net Cost		Prospective Net Cost	Cumulated Net Cost		Discounted Net Cost
	1914–34	1919–39	1939	1914–34	1919–39	1939
*Participating, Mutual Companies**						
First Five	$2.37	$2.36	$2.96	$ 9.27	$ 8.20	$ 8.82
Second Five	3.31	3.63	5.05	10.04	9.26	10.58
Third Five	3.70	3.62	4.19	10.40	9.29	9.74
16th–18th	3.46	3.66	4.43	10.25	9.37	9.92
18 Companies	2.73	2.78	3.57	9.57	8.57	9.32
Participating, Stock Companies†						
Five Companies	4.36	4.93	4.72	10.74	10.16	10.22
Non-Participating, Stock Companies§						
Seven Companies	na	4.94	5.96	na	9.86	10.92
Thirty policies	na	3.09	3.87	na	8.76	9.52

Sources: Little Gem Life Chart, 1934, 1939. Fliteraft Compend, 1939.

Averages are weighted according to total ordinary insurance in force on December 31, 1938. In case of companies issuing both participating and non-participating insurance, the weight is divided according to the proportion of each type in force.

* The 18 mutual companies, ranked in order of assigned weight: Metropolitan (Endowment at Age 85 for "Actual History" and Cumulated; Paid up at Age 85 for Prospective and Discounted), Prudential (Endowment at Age 85 for Prospective and Discounted), New York Life, Equitable Life of New York, Northwestern Mutual, Mutual Life of New York, John Hancock (Endowment at Age 85 for Prospective and Discounted), Mutual Benefit, Penn Mutual, Massachusetts Mutual, New England Mutual, Connecticut Mutual, Provident Mutual, Bankers Life (Endowment at Age 85 for Prospective and Discounted), Phoenix Mutual, State Mutual, National Life of Vermont, and Guardian Life.

† Aetna, (Endowment at Age 85 for "Actual History"), Union Central, Connecticut General, Pacific Mutual (completely reorganized in 1936), and Equitable Life of Iowa.

§ Travelers, Aetna, Lincoln National (preferred risk), Connecticut General, Pacific Mutual, Equitable Life of Iowa (Endowment at Age 85 for "Actual History" and Cumulated), and Western and Southern.

to an annual equivalent by a coefficient of accumulation (29.3215). The crude figures are divided by 20, according to orthodox procedure. All data pertain to the Massachusetts Mutual Life Insurance Company, participating ordinary life.

averaged with weights according to the amount of ordinary insurance carried at the end of 1938. The cost of participating insurance is compared with nonparticipating; and mutual companies are separated from stock companies.

The data in Table II suggest several points worthy of note. Restricting ourselves for the time being to the 18 mutual companies who do the lion's share of the business,[13] we perceive that the very largest companies have the lowest costs according to all six measurements. This is a fact familiar to many interested people; yet it apparently escaped the attention of the TNEC investigators.[14] Ordinarily, there has been a fairly consistent correlation between the size of a company and its competitive position in respect to long-term cost; but this relationship was ruptured by the low 1939 dividend scale of the sixth largest concern.[15] Secondly, we find that the deferred dividend plan does not disturb the ranking of the companies to an appreciable extent if costs are measured over a twenty-year period, at least under the assumptions we have made as to earnings lost in an alternative investment.[16]

Table II shows, thirdly, that the cost of participating straight life insurance, if kept in force for a moderately long period of time, has not increased in recent years to anywhere nearly the extent indicated by crude cost figures. Indeed, it appears that the cumulated cost fell between 1934 and 1939 by an amount averaging a dollar per year per thousand for the 18 mutual companies. Even with the assumption of $3\frac{1}{2}$ per cent as an alternative interest rate, the rise in premium rates and surrender charges, and the projection of a comparatively low dividend scale for twenty years to come, we see that the discounted cost is lower than the cumulated for 1914–34, and comparatively little higher than that of 1919–39. We shall return to this presently.

As for the stock companies, Table II brings out that over the period

[13] At the end of 1938 these 18 companies had a total of over 54 billion dollars of ordinary life insurance in force out of an aggregate of some 63 billions for the 26 concerns. Slightly less than 110 billions of all life insurance (ordinary, industrial, and group combined) was carried by 308 companies at the end of the year 1937; and the eighteen companies grouped above held over 77 billions. See *Hearings*, Pt. 10, p. 4733; Pt. 10-A, pp. 4, 26.

[14] It is remarkable that the statistical report (Part 10-a of the *Hearings*) listed the companies in the order of size in every table except those concerning costs. In the latter, the companies are listed in alphabetical order. It is also to be noted that Massachusetts Savings Bank Life Insurance has a lower net and cumulated cost than any of the largest companies. The costs of the Whitman Savings Bank (the first bank to issue life insurance) for the period 1919–39 are *minus* $0.60 (crude) and *plus* $4.98 (cumulated). Thus, there appear to be advantages in very large size which may be more than offset by a different type of organization.

[15] The Mutual Life Insurance Company of New York (oldest commercial company in operation).

[16] This would be more evident if all the data for the individual companies were on display. The Metropolitan, the New York Life, and the Equitable (three of the five largest companies) have employed conservative dividend plans for many years.

1919–39 their participating insurance was more expensive than either their own stock insurance or the participating insurance issued by the mutuals. However, non-participating rates have been increased so much in recent years that this type of insurance, under our assumptions, is now the most expensive of all. In truth it would require a very high rate of interest on alternative investment to raise the discounted cost of the five largest mutuals ($8.82) so as to exceed that of the seven largest stock companies ($10.92). To be sure, a further lowering of dividends on participating policies would have a similar effect.

In respect to the apparent decline in twenty-year costs between 1934 and 1939, a most important element in the situation is the discrepancy between the rate of dividends paid since 1933 by life insurance companies on the one hand, and savings banks on the other. The influenza epidemic of 1918 may have some bearing upon the subject, as may also the fact that the ratio of expenses to premium income has been undergoing a steady decline since 1920.[17] Nevertheless, these other factors will not explain why the crude historical cost failed to decline between 1934 and 1939 while the cumulated cost was decreasing to a notable extent. A shrinkage took place in the average loss of interest which amounted to some $1.05 per year per thousand dollars of insurance for the 18 mutual companies taken as a group.[18]

It is to be emphasized that a conclusion that the cost of protection has not risen to any extent in recent years—in fact has fallen if viewed from one angle—rests upon the assumptions that (1) a conservative savings bank is a fitting alternative investment and (2) life insurance stays in force at least twenty years. The second assumption is probably the weaker of the two since only a relatively small number of contracts fulfill this condition.[19] It may be fairly stated that the high lapse ratio, together with the high expense of issuance, is the most vexing problem facing the institution of American life insurance. The solutions proposed by the companies have been conservation campaigns and group insurance, whereas social security and savings bank insurance are alternate programs now being prosecuted.

It has been estimated that the average ordinary life insurance policy remains in force not more than seven years; but comprehensive cost

[17] The decline of this ratio (from 22.72 per cent in 1920 to 14.13 per cent in 1937) may be primarily due to the increase in the premium income. See *Hearings*, Pt. 10, p. 4820.

[18] The lost interest is the difference between the cumulated and crude net costs. For the period 1919–39 it averaged only $5.79 per year ($8.57 less $2.78) whereas it had been $6.84 for 1914–34 ($9.57 less $2.73).

[19] A large part of the TNEC testimony is devoted to the problem of lapsed insurance. See especially Part 10, pp. 4283, 4293-a, 4619 *ff.*, 4722, *et passim*. See also L. R. Martin, "Withdrawal Rates in the Connecticut Mutual," *Transactions of the Actuarial Society of America*, vols. XXXVIII–XXXIX.

data are not available for so short a period. However, we are fortunate in having figures at hand both for the ten-year interval 1929–39 and for the corresponding prospective period, all applicable to a contract similar to the one already examined (Table III).

Both the crude and adjusted figures in Table III indicate that the cost of life insurance on a ten-year basis is rising to an appreciable

TABLE III

COMPARISON OF NET COSTS, 1929–39

Weighted Averages of the Annual "Actual History" Net Costs and Cumulated Net Costs of Ordinary Life Insurance, Age 35, in 26 Leading American Companies over the Period 1929–39. Weighted Averages of the Prospective and Discounted Net Costs for Similar Policies Issued in 1939, to be Surrendered Ten Years Later.

	Actual History Net Cost 1929–39	Cumulated Net Cost 1929–39	Prospective Net Cost 1939	Discounted Net Cost 1939
*Participating, Mutual Companies**				
First Five	$6.22	$8.55	$ 7.38	$10.09
Second Five	6.46	8.73	7.94	10.64
Third Five	6.23	8.47	7.06	9.78
16th–18th	6.28	8.57	6.76	9.53
18 Companies	6.28	8.58	7.45	10.17
Participating, Stock Companies†				
Five Companies	7.65	9.69	7.86	10.49
Non-Participating, Stock Companies§	6.92	8.76	10.37	12.36
Thirty policies	$6.40	8.64	7.78	10.41

* See Table II, note*
† See Table II, note†
§ See Table II, note§
Sources: See Table II.

extent. The assumption of a future interest rate of 3½ per cent is partly responsible for the fact that the loss of interest is considerably larger for prospective figures than for historical.[20] Another conclusion suggested by Table III perhaps of equal or greater importance, is that the very largest companies show little or no advantage in cost where the period of protection is only ten years in length. The deferment of dividends becomes a critical factor. This is particularly significant because in the past the average policy has remained in force even less than ten years. Moreover, non-participating rates compare favorably with participating if past experience alone is considered; yet the former

[20] The spread between crude and adjusted cost figures is generally much smaller for a ten-year than a twenty-year period (see Table II). Thus, the average for the historical cost for the 18 mutual companies taken as a group is only $2.30. This spread tends to be an absolute amount for a given type of policy and a given period of protection. That is, there is less dispersion among the absolute differences for the various companies than there is among the ratios of the cumulated to the respective crude costs.

are considerably higher according to 1939 quotations.[21]

The few data available on five-year net costs indicate an even more abrupt rise in the cost of carrying life insurance. Let us consider only contracts issued by the two national companies which lead the field in most cost comparisons. The Metropolitan Endowment at age 85 had a five-year cumulated net cost of $9.79 for the period 1929–34; but a policy Paid up at age 85, which should be less expensive under the same conditions, cost $11.87 annually for the interval 1935–40 (before April 30).[22] Such an increase ($2.08) represents a difference of over 21 per cent. A still larger increase is indicated by the Northwestern Mutual ordinary life policy. One of these, if surrendered in 1933 (after being in

TABLE IV

COMPARISON OF NET COSTS, 3 TYPES OF POLICY

Unweighted Averages of the Annual "Actual History" Net Costs and Cumulated Net Costs of Participating Ordinary Life, Twenty Payment Life, and Twenty Year Endowment Life Insurance Policies, Age 35, in 15 Selected Companies, for the Periods 1914–34 and 1919–39.

	1914–34			1919–39		
	"Actual Hist." Net Cost	Cumulated Net Cost	Diff.	"Actual Hist." Net Cost	Cumulated Net Cost	Diff.
Ordinary Life	$ 3.39	$10.14	$ 6.75	$ 3.53	$9.21	$ 5.68
20 Payment Life	− 2.84	9.31	12.15	− 2.27	7.96	10.23
20 Year Endow.	−12.08	7.99	20.07	−10.98	6.00	16.98

The Companies: Aetna (endowment at age 85 and twenty payment endowment at age 85); Atlantic (preferred risk); Equitable Life of New York; Jefferson Standard (preferred risk); John Hancock; Massachusetts Mutual; Metropolitan (endowment at age 85 instead of ordinary life); Mutual Benefit; Mutual Life of New York; New England Mutual; New York Life; Northwestern Mutual; Penn Mutual; Prudential; and Sun Life Assurance Society of Canada.

Sources: See Table II.

Note: A minus sign (−) indicates "net return to the policyholder."

force five years) cost only $6.82 per year with allowance for the loss of interest; the corresponding figure was $9.33 seven years later.[23] The raising of the surrender charges borne by policyholders who turn in their policies after only a few years is the most important factor in this extraordinary increase.

Space forbids extensive discussion of twenty-payment life, twenty-year endowment, and other forms of life insurance, (or annuities) in which the interest item is of great quantitative importance. Table IV

[21] According to the 1939 prospective figures, only one standard non-participating policy has a lower net cost than the participating policy with the highest figure; and only one of the latter is higher than the lowest of the former. *Hearings*, Pt. 10-A, pp. 286–87.

[22] The corresponding crude costs are $8.24 for the earlier and $11.01 for the later date. Although the loss of interest over so short a period is relatively small, the variation in its size is striking: for the earlier quinquennium it was $1.55 per year, for the later only 86 cents.

[23] The crude cost figures are $4.92 (1928–33) and $8.42 (1935–40).

contains unweighted averages of annual costs for a group of 15 companies, so arranged that the figures on ordinary life may be compared with those on twenty-payment life and twenty-year endowment. The data are restricted to the twenty-year periods 1914–34 and 1919–39.[24] It will be noted that all three forms show a decline in cumulated cost between 1934 and 1939 although they rose in respect to crude cost. The necessary adjustment for loss of interest is necessarily greater in the case of the higher-premium forms; and as might be expected, there has been a notable decrease in that loss due largely to the drastic cut in savings bank dividends during the depression. The discrepancies in the cumulated figures are almost entirely owing to differences in the extent of protection provided by the policies; that is, if further adjustments were made to allow for shrinkage in the amount at risk, it would be found that all three types were about equally cheap (or expensive) so far as protection was concerned.

It is admitted that the cost data submitted herewith leave much to be desired. In particular, they tell us nothing as to behavior of the cost of protection from year to year. However, the method employed here in an experimental manner may be extended to include the study of other years. An annual index could be constructed with comparative ease from data which are not inaccessible. Figures for different policies in various companies could be weighted by the respective amount of each in force. As for the choice of period—which appears to exert a significant effect upon the results—it seems advisable to employ a five-year, or at the most a ten-year period. As already pointed out, the life of the average policy is between five and ten years. Furthermore, a shorter period reflects current changes more readily than a longer one.

Before closing this discussion, we may focus attention upon three questions. The first concerns the concerted action of the life insurance companies in raising premium rates and surrender charges on various occasions since 1932, notably at the beginning of the year 1935. The second has to do with their motives for adjusting the scale of charges so as to penalize a policyholder who surrenders within a few years; while the third deals with the wisdom of savings bank executives in their dividend policies during and since the depression.

The nature, extent, and desirability of competition in the insurance

[24] In connection with the endowment, a simpler and perhaps more appropriate method of reckoning cost is suggested. Find the annual bank deposit necessary to accumulate a given cash surrender value according to past dividends. Then subtract the total of such deposits from the net premiums paid to the life insurance company. This posits an annual saving which is constant whereas the method employed above posits a constant annual expense. The former usually gives a slightly lower cumulated cost in the case of participating policies since the net premiums decrease over time. For non-participating policies both methods give the same results.

business have long been topics for discussion in scientific writings and for arguments before courts of law. And the belief has long been gaining currency that no arrangement approaching the freely competitive market usually assumed in economic theory is or ought to be applicable to this field of finance. In spite of this trend, anti-trust statutes of several American states still treat a concerted action by insurance companies in respect to rates or policy forms as a type of behavior of the same category as conspiracies in restraint of trade in commodities.[25] It is evident from the TNEC hearings that the companies are sensitive to their unfavorable legal position in some jurisdictions in respect to collusion over rates.[26] At the same time, one or two of the members of the Committee appear to regard agreements to raise non-participating insurance rates or lower surrender charges as more similar to rate agreements among public utility companies.[27] This may or may not be a sound comparison of the two types of coordination. The problem is complicated by the realization that it is conceivable that insurance companies, working hand in hand (or rather under heavily concentrated control), may maintain extortionate rates against which the public has little relief. Nevertheless, the companies' recent action, in the face of falling earnings (and an even gloomier outlook as to interest rates), may more properly be compared with an agreement among banks to avoid ruinous competition in the payment of interest or the award of loans. Indeed, it is not so many years ago that Congress decided to suppress competition in the payment of interest (so far as demand deposits are concerned). Is this to be considered as a departure from tradition similar to the NRA? Or does it represent a recognition that competition in banking and investment stands on a different footing from the competition achieveable, and perhaps desirable, in the production or distribution of goods and services?

In respect to the second matter—the particular elevation of short-term insurance costs—there is ample evidence that the primary motives of the companies were: (1) to discourage sudden cash withdrawals; and (2) to reconcile a high interest rate already guaranteed to old policyholders with a prospect of low earnings.[28] Surrender charges on policies in force twenty years or more were not freshly imposed by the leading companies (although they had power to do so) largely because there are only a comparatively small number of such contracts. It was estimated that a loss of good will (together with the selling advantages

[25] Several statutes are reprinted in the TNEC *Hearings*. See Part 10, p. 4692 *et seq.*

[26] *Ibid.*, p. 4690.

[27] *Ibid.*, p. 4216 *et passim*. It is fair to the Committee to recall that its major purpose is to study the extent to which economic power is concentrated in the hands of a few.

[28] *Ibid.*, pp. 4269–71, 4619, 4622–23, 4626–29, 4722, *et passim*.

incident to long-term cost exhibits) overbalanced the gain entailed in charges on these particular policies.

Much has been said and written about the inequity of surrender charges in life insurance; and the justification has lain for the most part in the fact that the expense of issue is high (agents' commissions, medical examinations, etc.). The Massachusetts savings banks system has attacked the problem by dispensing with solicitors—a step which other companies are loathe to take. On the other hand, the latter have accomplished a great deal by the issue of group life insurance. In one respect there is a measure of fairness in the current arrangement of surrender charges, for the present at least. We do not refer to the fear of withdrawal professed by the company officials. On the contrary, it would seem that some measure is necessary—and has been for a number of years—to prevent new policyholders from securing more than their just share of the company earnings.

It is ironical that, shortly after the companies began to raise these charges, hoarding took the form of depositing sums of tremendous aggregate size in the very safest types of financial institutions. The withdrawal campaign turned into a deposit campaign. At the same time, opportunities for investment continued to be poor. Partly as a result of this situation, and also partly as a survival of the fear of withdrawals, the insurance companies (and other financial institutions) have kept large sums in cash on hand. Needless to say, they have earned little or nothing on money left in their keeping for periods as short as three, four, or five years. But on the other hand, the funds deposited before the depression by old policyholders, which had been converted into assets of higher yield, continued to supply most of the income. Hence, there is perhaps less inequity under the present situation in charging a short-term policyholder a higher price for his protection. At the same time, such a distribution of earnings harmonizes with the policy of the life insurance company to remain in the field of long-term investment.

In closing, we may ask whether it would not be appropriate at the present time for savings banks to adopt a similar policy of granting returns to depositors more or less in accordance with the age of their accounts. Like life insurance companies, the banks prefer to specialize in long-term securities and mortgages; and they have also experienced large cash deposits over the past few years. Their reaction has been to lower the dividend rate drastically upon all balances, whether old or new, whether dependable or not.[29] Many bank deposits have been

[29] Indeed, this low bank rate was a potent factor in driving funds into life insurance and annuities.

withdrawn—and will continue to be withdrawn—without sharing in investment in approved assets. Hence it is not fair to the bank's older accounts to force them to share equally with "anxious money" in the partition of earnings. A sliding-scale dividend rate in a savings bank should buttress its position in the low-cost and high-yield field of long-term investment. Perhaps the chief objection by bankers is that it would discourage the opening of accounts. It is difficult to refuse new cash if the fear of sudden withdrawals lingers among us. Then again, bank executives may reason that cash—even if idle—is worth its dividend because it may help protect other, more useful, assets.

CHANGING SEASONAL FLUCTUATIONS IN THE AMOUNTS OF PUBLIC AND PRIVATE ASSISTANCE AND EARNINGS ON CWA AND WPA PROJECTS IN 116 URBAN AREAS, 1929–38

By Dwight B. Yntema
Work Projects Administration

An earlier endeavor to eliminate seasonal fluctuations in the monthly totals of relief extended in 116 urban areas in the United States, 1929–38, did not achieve a satisfactory solution.[1] The implicit assumption of identically recurrent seasonal fluctuations resulted in the use of unchanging seasonals that were unsuited to the data. During the first part of the 10-year period the percentage adjustments for seasonal variation were insufficient to remove the seasonal element and in the later years the adjustments led to overcorrections.[2] In reconsidering the measurement and elimination of seasonality in the data for the 116 urban areas, the following discussion first notes the programs covered by the compilation. It then comments on the factors and forces responsible for seasonal fluctuations and for the progressive changes that appear in such fluctuations. Finally a method for isolation and measurement of the changing seasonal element is outlined.[3]

The urban assistance and earnings totals, shown in Chart I, inevitably reflect the widely divergent auspices and agencies under which assistance and earnings were provided during the 1929–38 decade. Two basic movements were in progress: (1) the provision of assistance and project work—general relief, employment on work projects, and aid for categorical groups including the blind, dependent children, and the aged—became more and more a function of public agencies and (2) both the amounts supplied to individual recipients and the number of recipients increased greatly. The rapid expansion in outlays may be attributed in part to the development of higher standards in providing assistance and project earnings and to a more general acceptance of responsibility for providing aid. A considerable if not the predominant portion of the increase, however, must be attributed to the rise and persistence of widespread unemployment.

The assistance and earnings totals compiled for the urban areas account for the greater part of all the public assistance and Federal

[1] Helen R. Jeter and Herman W. Gruber, "A Seasonal Index of Urban Relief," *Social Security Bulletin*, Social Security Board, Vol. I, No. 7 (July 1938), pp. 50–56.

[2] This result may be observed in either Chart II or Chart III of the source noted above.

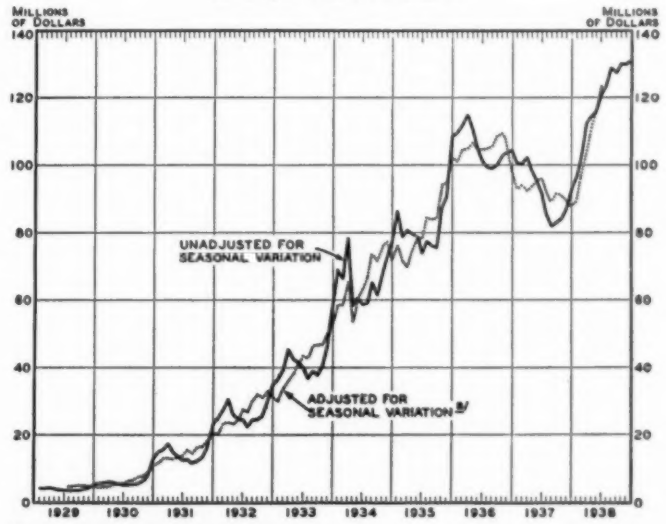
[3] The assistance and earnings totals analyzed in this discussion differ from the series used in the previously mentioned study as a result of minor revisions made by the Social Security Board and extension of the period covered by the series to include nine additional months. See "Statistics for Urban Areas," *Social Security Bulletin*, Social Security Board, Vol. II, No. 3 (March 1939) p. 52.

work and construction project earnings in the urban areas even though the operations of certain agencies are not covered.[4] The composition of the totals, as shown in Table I, indicates that the relative importance of private funds has been very small since the initiation of Federal participation in 1933. Prior to 1933 and from 1936 to the end of the decade,

CHART I

AMOUNTS OF PUBLIC AND PRIVATE ASSISTANCE AND EARNINGS ON CWA AND WPA PROJECTS IN 116 URBAN AREAS[A]

January 1929–December 1938



A/ ORIGINAL DATA SUPPLIED BY SOCIAL SECURITY BOARD.
B/ SEE TEXT FOR NATURE OF ADJUSTMENT.

WPA 3234

state and local agencies provided all, or substantially all, of the public funds used for general relief programs; these agencies likewise financed the special types of assistance from 1929 through 1935. Federal funds

[4] Among the activities commonly covered in compilations (1933 to date) for the country as a whole but not included in the urban area compilations are the following: the four special programs of the Federal Emergency Relief Administration; the subsistence payments made as grants to farm families by the Farm Security Administration; the employment provided on Federal agency projects that was financed with transferred WPA funds (such projects are similar to WPA projects); the activities of the Civilian Conservation Corps and the National Youth Administration; and the employment provided on work and construction projects of "other Federal agencies." The last includes the programs of the Public Works Administration and the Public Roads Administration and the work and construction project programs of various additional Federal agencies, that were developed or expanded in meeting the emergency arising from the depression. For the continental United States as a whole, the payments to recipients made from 1933 to 1939 through the several omitted programs constituted roughly from one-fourth to one-third of the country-wide totals for all the public assistance and Federal work and construction project activities. In most years at least half of the totals for the omitted programs were accounted for by the other Federal agency programs. (See *Report on the Progress of the WPA Program, June 30, 1939*, Work Projects Administration, 1940, pp. 129–152 and *Fourth Annual Report of the Social Security Board*, Social Security Board, 1940, p. 274.)

were expended predominantly in extending general relief during the FERA period, in operating the CWA and WPA work project programs, and in expanding the special types of public assistance after 1935.[5]

TABLE I

DISTRIBUTION OF TOTAL AMOUNTS EXPENDED IN 116 URBAN AREAS FOR PUBLIC AND PRIVATE ASSISTANCE AND FOR EARNINGS OF PERSONS EMPLOYED UNDER THE CIVIL WORKS PROGRAM AND ON PROJECTS OPERATED BY THE WORK PROJECTS ADMINISTRATION, BY TYPES OF PROGRAMS*

January 1929—December 1938

Year	Total Amount ($1,000)	Percentage Distribution				
		Total	Public Funds			Private Funds
			General relief—direct and work	Federal work programs	Special types of public assistance	
1929	47,215	100.0	34.8	—	41.0	24.2
30	75,671	100.0	46.9	—	29.2	23.9
31	177,840	100.0	51.0	—	20.0	29.0
32	319,405	100.0	68.0	—	13.6	18.4
33	501,500†	100.0	80.1	5.6†	8.4	5.9
1934	793,241†	100.0	77.5	14.9†	5.6	2.0
35	990,937	100.0	78.1	14.5	6.1	1.3
36	1,260,040	100.0	23.8	68.0	7.3	0.9
37	1,099,562	100.0	25.9	58.9	14.2	1.0
38	1,432,306	100.0	22.7	62.8	13.8	0.7

* Adapted from Table 4 in "Statistics for Urban Areas," *Social Security Bulletin*, Social Security Board, Vol. II, No. 3 (March 1939), p. 58.

† The CWA data (1933 and 1934) have been adjusted to exclude earnings of nonrelief workers as explained in footnote 5; WPA data for 1935 through 1938, however, include the relatively unimportant earnings of nonrelief workers.

Analysis of the forces underlying seasonal fluctuations in the assistance and earnings totals necessarily must consider the effects of the "geophysical yearly cycle"[6] on the physical requirements of human beings. The additional necessities of the needy for shelter, clothing, nourishment, and other goods and services during the winter tend to increase the totals of assistance and earnings at that time. Extensive as well as intensive margins are involved: the former by persons who

[5] See discussion of the amounts of assistance and earnings in the 116 urban areas, 1929–38, in *Social Security Bulletin* (March 1939), *op. cit.*, pp. 58–60.

A single adjustment in the original data was required because of the inclusion in the series of the earnings of all CWA workers—both relief and nonrelief—during the few months in which the Civil Works Administration was conducting its program. In eliminating the nonrelief element variable percentages of the total CWA earnings were deducted—as much as 55 per cent in November and December 1933, and January 1934, and as little as 45 per cent beginning in March 1934. A similar procedure was evidently used in the previously mentioned analysis of seasonal fluctuations.

[6] *Cf.* Horst Mendershausen "Eliminating Changing Seasonals by Multiple Regression Analysis;" *The Review of Economic Statistics*, Vol. XXI, No. 4 (November 1939) p. 171.

are self-sufficient during the less rigorous months of the year, the latter by persons receiving increased allowances during the winter. Although the direct physical factors do not operate in exactly the same manner in different years, they are not likely to cause any significant change in the timing and general pattern of the seasonal movement in the assistance and earnings totals for the urban areas.

Seasonal changes in the urban assistance and earnings figures also reflect the seasonal movements in the socio-economic phenomena, such as unemployment, which modify the ability of persons to be self-sufficient. Changing seasonality would be expected if substantial shifts have taken place in urban unemployment, the lag between seasonal unemployment and provision of assistance or work, administrative practices of agencies providing project work or assistance,[7] and related factors. Lacking precise knowledge with regard to shifts of such kinds, it may be assumed that the social-economic elements have not introduced important alterations in the essential seasonal pattern with the possible exception of modifications in the relative amplitude of the seasonal movement. The influence of factors making for changes in amplitude requires special consideration.

Substantial shifting in the relative amplitude of the seasonal component must be anticipated from even a summary review of the forces affecting seasonal variation. Most important during the 1929–38 decade was the episodic growth in the amounts of assistance and earnings. This growth gave to the totals an increasing body content upon which seasonal forces played in the role of peripheral influences with diminishing relative importance. It reflected both an improvement in the standards used in providing assistance and wage payments to individual recipients and a broadening of the sphere in which the programs were carried on so as to benefit larger numbers of recipients. Inherent to the growth was the development of programs operating under rigid annual appropriations and free from a monthly reinvestigation of the needs of recipients. Such programs accomplished a more general use of fixed allowances provided to individual recipients. Al-

[7] Recognition must, of course, be given to changes in the relative importance of programs of different agencies if their activities display distinctive seasonal characteristics. A shift in the relative importance of the special types of assistance programs having small seasonal movements, for example, would modify the relative amplitude of the seasonal movement in a total for several programs if offsetting changes did not occur in the other programs. Some offset might be expected if the change in the importance of the assistance programs is effected through transfers of recipients between the special assistance and other programs.

Differences in accounting and reporting practices should also be considered since these can result in different timing in the reported amounts of assistance or earnings. Two points deserve special consideration: the stage in the several accounting or other processes at which the report is made and the definition of the month for reporting purposes, whether it be calendar days, weeks ending during the month, or of some other nature.

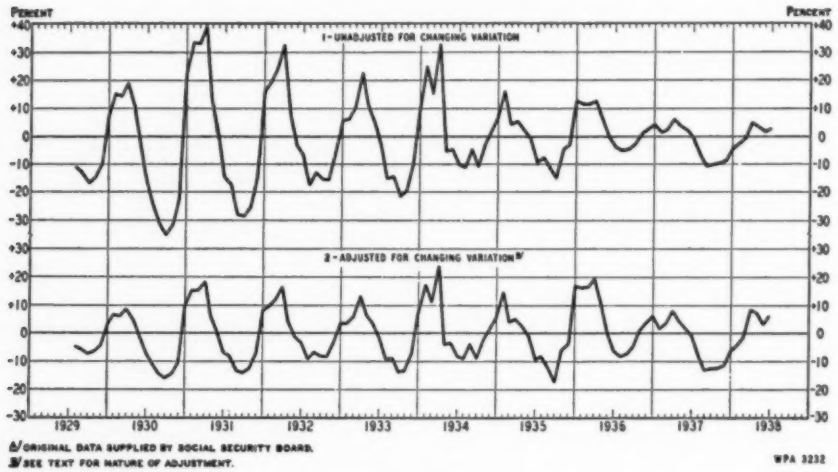
though the several factors tended to reduce the relative size of the amplitude of the seasonal movement, they fell far short of eliminating the seasonal element. Important seasonal fluctuations in the aggregate number of recipients were present even when the assistance and earnings totals were at their maximum. Such adjustments arose, for example, through the seasonal expansions and contractions in the work project and general relief programs. Seasonal changes in the amounts of relief extended to individual recipients also persisted, albeit less

CHART II

RELATIVE SEASONAL DEVIATIONS FROM MOVING AVERAGE

Assistance and Work Project Earnings in 116 Urban Areas

January 1929–December 1938[A]



generally; these were characteristic of the general relief programs which in theory at least provided aid on budgetary deficiency or equivalent bases allowing for increased benefits during the winter.

The seasonal variation that occurred in the assistance and earnings totals may be observed in the upper section of Chart II which depicts the percentage deviation of each original observation from its corresponding 12-month moving average.[8] That there were important changes in the relative size of the seasonal movement is apparent. Study of the chart reveals that positive deviations predominated from December to April and negative deviations from June to October, with March the high and September the low month. The progressive changes

[8] Graphic modification from inspection of a chart showing the 2-month moving average of the 12-month moving average was not undertaken although this device is sometimes used to correct for the tendency of the moving average to "cut inside" the shorter "cyclical" fluctuations at their high and low levels.

in the seasonal component appear to be limited to changes in amplitude.[9]

The dominating role of the growth factor and the accompanying reduction in the relative size of the seasonal fluctuations have already been noted. Consideration of the relationship between the two strongly suggests that the essential character of the seasonal movement implies an important connection between the seasonal amplitude and the amount of assistance and earnings. The relationship is shown graphically in Chart III which is a scatter diagram of the annual dispersion (i.e., the 12-month total of the absolute values of the percentage deviations of observed from trend values) and the corresponding yearly total of assistance and earnings. The various points are connected in time sequence with those points labeled which represent the paired values for July of each year. The chart indicates that the amplitude tended to diminish as yearly totals of assistance and earnings increased. The regression line, drawn in from inspection of the chart, provides a measure of this relationship.[10]

The regression developed in Chart III may be used in correcting the gross seasonal deviations so as to obtain magnitudes that are independent of the assistance and earnings totals. The reduction is accomplished by dividing each gross seasonal deviation by the corresponding expected annual dispersion. Such reduced values, shown in the lower section of Chart II, in effect measure the percentage of the

[9] A progressive seasonal movement limited to changes in amplitude represents a very particular type of changing seasonal. In dealing with this kind of changing seasonal a number of methods can be employed. Some require study of the gross seasonal values of each of the 12 months, analysing the changes that appear when the percentage deviations of any one month are plotted chronologically. Such methods assume that the change in the seasonal component of a given month has taken place continuously through time and consequently sudden shiftings in amplitude tend to be given inadequate recognition. Alternative methods are found in various uses of Kuznets' amplitude ratio. These undertake to modify the stable seasonal index for a given month by some changing factor and the changing seasonal of a given month of a given year becomes the stable index adjusted in accordance with some characteristic of the amplitude ratio for the 12 months centered about the given month. Procedures of this kind must rely on the essential usefulness of the amplitude ratio for the purpose and a reasonable freedom of the ratio from excess distortion resulting from random factors. *Cf.* Horst Mendershausen "Methods of Computing and Eliminating Changing Seasonal Fluctuations"; *Econometrica*, Vol. 5, No. 3 (July 1937) pp. 251–3 and passim; also Simon Kuznets, *Seasonal Variations in Industry and Trade*, National Bureau of Economic Research, New York, 1933, Chapters 10 and 11, particularly pp. 322–324.

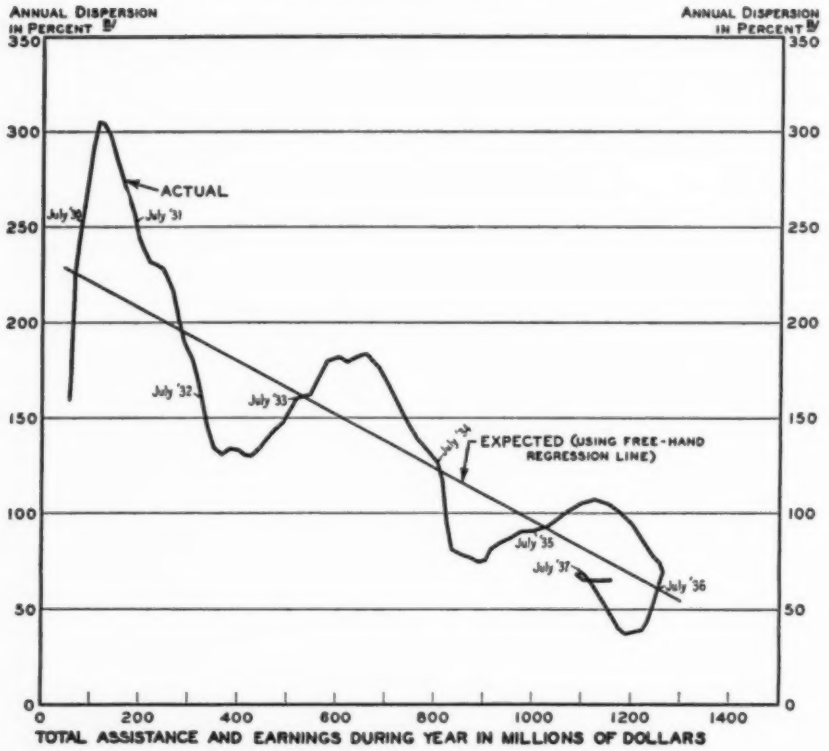
[10] Separate study can be made of this relationship in each of the twelve months. When charts are drawn of the regression of the observed seasonal deviations of a particular month on the corresponding annual amounts of assistance and earnings, it is found that in each case the seasonal deviations vary with the assistance and earnings totals. It is noteworthy that the regression line shown in Chart III has its counterparts in each of such monthly diagrams. The X-intercepts of the lines in the several monthly charts are of the same magnitude and equal to the X-intercept that is obtained by extending the line in Chart III. The slope of the line in any one of the monthly charts is the slope of the line in Chart III (a negative value) times the percentage of the annual dispersion that has been calculated for that month including the sign of the percentage, as shown in the second column of Table II. The fact that the lines so drawn in the several monthly charts approximate the regressions that are indicated by the plotted points is evidence of the acceptability of the assumption of seasonal change limited to change in amplitude.

expected 12-months dispersion that applies to the given month. After this reduction the remainder of the analysis can be carried out by use of the methods employed in calculating unchanging seasonals.

CHART III

ANNUAL DISPERSION OF RELATIVE SEASONAL DEVIATIONS AND YEARLY TOTALS OF ASSISTANCE AND EARNINGS

Assistance and Work Project Earnings in 116 Urban Areas
January 1929–December 1938[A]



A/ ORIGINAL DATA SUPPLIED BY SOCIAL SECURITY BOARD.

B/ MOVING TOTAL OF ABSOLUTE VALUES OF PERCENTAGE DEVIATIONS FROM MOVING AVERAGE. WPA 3233

The steps involved in the computation and elimination of the changing seasonals are outlined in the accompanying heading for a tabular work sheet. It will be noted that column 7 provides data for the upper section of Chart II and columns 9 and 4 the paired observations plotted in Chart III. Column 10 is read from the line of expected relationship in Chart III, using the annual assistance and earnings totals of column 4 as the independent variable. Column 11 accomplishes the reduction of gross seasonal deviations to relatives of the expected annual disper-

sion as determined from Chart III. Typical magnitudes for each month in the year are next derived, and for this purpose the arithmetic mean of the three "median" magnitudes was used. These are shown in the second column of Table II and entered in column 12 of the tabular form. The remaining operations provide expected changing seasonal deviations and indexes and eliminate the seasonal component from the original series.

HEADING OF TABULAR FORM FOR ELIMINATING CHANGING SEASONAL FLUCTUATIONS

Year and Month	Original series	12-mo. moving total of (2) entered in 6th month	Annual total 2-mo. moving average of (3) entered in 2nd month	Monthly average $\frac{(4)}{12}$	$\frac{(2)}{(5)} \cdot 100$	Gross seasonal deviation (6)−100	12-mo. moving total of absolute values of (7) entered in 6th month
	(amount)	(amount)	(amount)	(amount)	(per cent)	(per cent)	(per cent)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

Observed annual dispersion 2-mo. moving average of (8) entered in 2nd mo.	Expected annual dispersion value associated with total in (4), as read from Chart III	Uncorrected seasonal deviation $\frac{(7)}{(10)} \cdot 100$	Reduced seasonal deviation transcribed from Table II	Changing seasonal deviation $\frac{(10) \cdot (12)}{100}$	Changing seasonal index 100+(13)	Series adjusted for seasonal $\frac{(2)}{(14)} \cdot 100$
(per cent)	(per cent)	(per cent)	(per cent)	(per cent)	(per cent)	(per cent)
(9)	(10)	(11)	(12)	(13)	(14)	(15)

Table II also shows the seasonal deviations and indexes for total seasonal movements of 75 and 150 percentage points (columns 3–6). Such seasonal variations obtained when yearly totals of assistance and earnings approximated $1,150,000,000 and $610,000,000, respectively. The larger of the annual totals characterizes in a general way the period from late 1935 through 1937 and the smaller, the months in the latter half of 1933. Irrespective of the particular amplitude expected from a given level of assistance and earnings, the seasonal movement found by the foregoing analysis is at its height in the first quarter of the year with the March deviation accounting for 14.7 per cent of the year's aggregate fluctuations. The somewhat smaller size of the February seasonal must be attributed in large part to the smaller number of days in the month—a factor that is necessarily reflected in assistance

and earnings totals. After successive declines in April, May, and June the seasonal fluctuation reaches its low level in the period from July through October. November and December occupy intermediate positions in the rapidly rising seasonal swing that precedes the highs of the January-March quarter.

TABLE II

SEASONAL DEVIATIONS AND INDEXES APPLYING TO ANNUAL DISPERSIONS OF 75 AND 150

Assistance and Work Project Earnings in 116 Urban Areas, January 1929—December 1938*
(per cent)

Month	Reduced Seasonal Deviation		Annual Dispersion =75		Annual Dispersion =150	
	Unadjusted†	Adjusted§	Seasonal Deviation	Seasonal Index	Seasonal Deviation	Seasonal Index
January	10.3	12.0	9.0	109.0	18.0	118.0
February	7.8	9.2	6.9	106.9	13.8	113.8
March	12.8	14.7	11.1	111.1	22.1	122.1
April	5.1	6.3	4.7	104.7	9.4	109.4
May	− 0.4	0.3	0.2	100.2	0.4	100.4
June	− 5.6	− 5.3	−4.0	96.0	− 8.0	92.0
July	− 8.6	− 8.6	−6.4	93.6	−12.9	87.1
August	− 9.8	− 9.9	−7.4	92.6	−14.8	85.2
September	−11.8	−12.1	−9.1	90.9	−18.2	81.8
October	− 9.1	− 9.2	−6.9	93.1	−13.8	86.2
November	− 5.2	− 4.9	−3.7	96.3	− 7.3	92.7
December	6.2	7.5	5.6	105.6	11.3	111.3

* Original data supplied by Social Security Board.

† Arithmetic mean of three "median" magnitudes found for each month of the year (See column 11 of tabular form).

§ Adjusted by (1) adding a constant amount to each of the 12 magnitudes so as to make the sum of the resulting positive items equal to the sum of the absolute values of the resulting negative items and (2) adjusting the resulting values proportionally so that the sum of the absolute values of the 12 items equals 100.0.

SPECIFIC FERTILITY RATES FOR DETROIT*

By Carl H. Fischer and Henry H. Pixley
Wayne University

Introduction. In the course of a study of the factors which enter into population changes in the city of Detroit, the authors found need for a table of fertility rates by age for the women of the city. When such a table was found to be non-existent, a search was made for a suitable substitute; specifically, a fertility table for some other large industrial city with a similar population composition. A rather extensive correspondence with all agencies known to the authors which might have an interest in such data failed to reveal the existence of such a table.[1] The present paper is an outgrowth of the original study necessitated by lack of data on fertility rates for large industrial cities.

Annual Fertility Rates for All Women: 1930 and 1920. Annual fertility rates per thousand women residents of Detroit, distributed in five-year age groups, 10–14, 15–19, etc., were prepared from 1930 birth records of the Detroit Department of Health and the 1930 Census reports. Approximately 31,000 punch-card records of live births which occurred within the city to residents were sorted and tabulated according to age and color of mother, with the white group further subdivided into native-born and foreign-born. The number of births in each classification was corrected for the estimated number of births which had occurred in other localities to Detroit residents. The basis for the correction was the 1937 special report of the Bureau of the Census[2] in which an actual reallocation was made of all births in 1935 in the United States which occurred away from the city of residence of the mother. As this report did not differentiate by age, nativity, or color of mother, it was necessary to make an arbitrary adjustment among these various groups. It appeared reasonable, because of economic and social differences among the groups, to apply the greatest portion of the total correction for out-of-city births to the native-born group of mothers, a smaller portion to the foreign-born, and none to the Negro. The total correction for each of the racial groups was distributed among the various five-year age groups proportionately to the number of births in each age group. The actual annual fertility

* The authors wish to acknowledge their indebtedness to the Detroit Department of Health whose records of births furnished the principal part of the primary data of this paper. Without its cooperation and especially that of Mr. G. Arthur Blakeslee, Director of the Bureau of Vital Statistics, this study would not have been possible.

[1] Fertility rates for the District of Columbia are available (See *Population Statistics, 2. State Data*, National Resources Committee, October, 1937, Government Printing Office) but it was thought these might not be applicable to Detroit. A comparison of Detroit and the District of Columbia is made later in this paper.

[2] *Vital Statistics-Special Reports*. Vol. 3, No. 43, pp. 339–342. December 17, 1937.

rates were obtained by dividing the corrected number of births to the women in each group by the number of women comprising that group.

For purposes of comparison, corresponding fertility rates for five-year age groups were prepared for 1920 from the 1920 Census reports

TABLE 1

ANNUAL FERTILITY RATES PER 1000 WOMEN BY FIVE-YEAR AGE GROUPS; DETROIT: 1930–1920

Age group	Number of women 1930	Number of live births 1930	Annual fertility rate 1930	Annual fertility rate 1920	Ratio 1930/1920
A. *Native-Born White Women*					
10–14	58,207	11	0.2	0.5	—
15–19	51,739	2441	47.2	52.5	.90
20–24	54,930	6759	123.0	149.1	.83
25–29	49,803	5338	107.2	127.6	.84
30–34	42,619	3049	71.5	94.9	.75
35–39	37,127	1549	41.7	49.6	.84
40–44	26,672	345	12.9	18.1	.71
45–49	19,133	21	1.1	1.9	—
B. *Foreign-Born White Women*					
10–14	4,665	1	0.2	0.0	—
15–19	8,082	520	64.3	92.3	.70
20–24	14,474	2440	168.6	227.7	.74
25–29	21,273	3016	141.8	207.6	.68
30–34	23,085	2281	98.8	148.8	.66
35–39	24,996	1508	60.3	105.9	.57
40–44	20,342	468	23.0	44.0	.52
45–49	15,633	30	1.9	4.8	—
C. *Negro Women*					
10–14	4,009	5	1.2	6.3	—
15–19	4,045	476	117.7	159.1	.74
20–24	6,990	854	122.2	120.9	1.01
25–29	9,252	618	66.8	70.8	.94
30–34	7,430	356	47.9	38.9	1.23
35–39	6,181	167	27.0	23.0	1.17
40–44	3,479	38	10.9	12.2	.89
45–49	2,494	1	0.4	0.0	—

and a sample of births consisting of the approximately 9000 births which occurred in Detroit during the months of January, April, July, and October of 1920. Corrections like those made for the 1930 data were made for births which occurred in other localities.

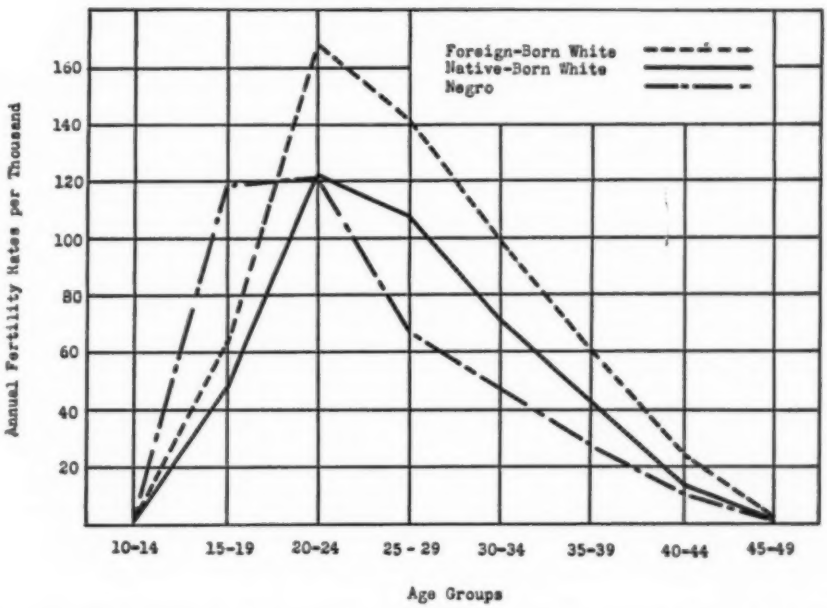
The births for 1930, the annual fertility rates by five-year age groups for both 1930 and 1920, and the ratio of the 1930 rates to the cor-

responding 1920 rates are shown in Table 1. In the last column the ratios for the two extreme age groups were omitted because of their possible unreliability due to relative scarcity of data

A graphical examination of the 1930 fertility rates, as shown in Chart 1, discloses a decided similarity in the patterns of the two white groups, although the foreign-born rates are at all ages distinctly higher than are the native-born. However, the Negro group exhibits

CHART 1

ANNUAL FERTILITY RATES PER THOUSAND WOMEN BY FIVE-YEAR AGE GROUPS, DETROIT, 1930



an entirely different fertility pattern, showing a markedly higher fertility in the age group 15–19 than either white group, but declining rather rapidly thereafter so that above age 25 the Negro rates are consistently the lowest of the three. These patterns are not restricted to urban populations. They apply also to the corresponding groups for the nation as can be seen by graphing a similar set of rates for the United States as given by P. K. Whelpton.[3]

The 1920 fertility rates, while higher throughout than those of 1930, show the same general patterns.

It will be observed that during the decade 1920–1930 the greatest proportionate decrease in fertility rates over the child-bearing period

[3] *Population Statistics, 2. State Data.* pp. 1–8.

as a whole has occurred in the case of the foreign-born whites, while the Negro group showed the smallest decrease. Thus the differential between the fertility rates of foreign-born and native-born whites decreased from 1920 to 1930, a phenomenon which was observed in a fertility study of Wisconsin.[4] The decrease in fertility for both white

TABLE 2

COMPARISON OF 1930 ANNUAL FERTILITY RATES PER 1000 WOMEN FOR DETROIT, THE DISTRICT OF COLUMBIA, AND THE UNITED STATES

Age group	ALL WOMEN			MARRIED WOMEN		
	Detroit	D. C.	U. S.	Detroit	D. C.	U. S.
A. Native-Born White Women						
15–19	47.4	43.7	47.2	381.1	404.6	408.1
20–24	123.0	93.8	130.8	219.7	213.4	258.5
25–29	107.2	88.3	125.5	138.9	133.1	269.0
30–34	71.5	59.5	91.4	86.5	83.2	112.4
35–39	41.7	32.3	58.5	50.5	47.4	71.4
40–44	12.9	9.3	22.8	16.1	14.2	28.4
45–49	1.1	.8	2.4	1.4	1.3	3.1
B. Foreign-Born White Women						
15–19	64.3	44.3	44.1	439.8	623.1	466.5
20–24	168.6	117.2	136.3	281.0	266.1	288.6
25–29	141.1	121.5	137.5	268.7	173.0	181.4
30–34	98.8	89.6	102.0	109.4	109.6	117.2
35–39	60.3	43.7	64.3	66.5	54.1	72.8
40–44	23.0	12.6	25.0	26.2	15.8	28.9
45–49	1.9	2.3	2.8	2.3	3.1	3.4
C. Negro Women						
15–19	117.7	102.8	100.3	318.7	588.6	488.8
20–24	122.2	101.9	139.0	162.5	181.7	230.2
25–29	66.8	60.9	104.6	81.7	86.0	142.2
30–34	47.9	41.4	81.5	59.5	57.0	107.1
35–39	27.0	24.7	55.4	34.6	34.5	73.7
40–44	10.9	9.2	21.9	15.4	14.0	30.7
45–49	.4	1.0	3.9	.6	1.7	5.8

groups became more pronounced with advancing age, whereas in the Negro group the only important decrease occurred in the most fertile group, that of ages 15–19. This latter comparison must be made with some caution, however, because of the comparatively small Negro population in Detroit in 1920 and the resulting small sample of Negro births for that year.

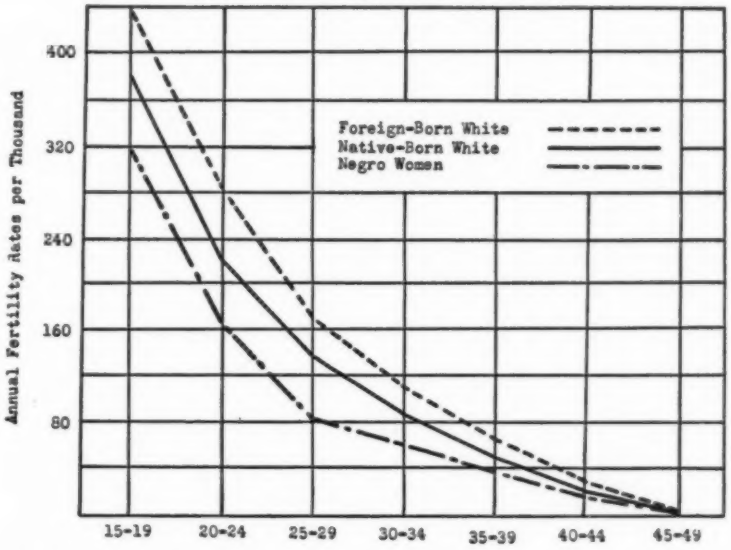
Annual Fertility Rates for Married Women: 1930. Annual fertility

[4] Thomas C. McCormick and Paul C. Glick, "Fertility-Rates in Wisconsin, 1920–35," *American Journal of Sociology*, Vol. XLIV, pp. 401–407, November, 1938.

rates for 1930 per thousand married women residents of Detroit, based on legitimate births only and subdivided by age, color, and nativity as in the cases above, are shown in the fifth column of Table 2 and in Chart 2. Correction was made for births occurring outside of the city.

CHART 2

ANNUAL FERTILITY RATES PER THOUSAND MARRIED WOMEN BY FIVE-YEAR AGE GROUPS, DETROIT, 1930



In this instance all three groups exhibit the same type of fertility pattern, with the foreign-born whites having uniformly higher fertility rates at all ages and the Negro group the lowest throughout, even for the age group 15–19. Even if illegitimate births are included in the computation of fertility rates for married women, the Negro rates remain the lowest at all ages. This seems to indicate that the relatively high rates for the younger Negro groups based on all women regardless of marital state, as in Table 1, are due principally to earlier marriages, and not to the relatively higher percentage of illegitimacy.

Comparison of 1930 Annual Fertility Rates for Detroit with those of the District of Columbia and of the United States.[5] In Table 2 are shown the 1930 annual fertility rates by five-year age groups for both All Women and for Married Women of Detroit, of the District of Columbia, and of the United States, subdivided further into native-born whites, foreign-born whites, and Negroes.

[5] *Population Statistics, 2. State Data.* It should be noted here that these rates prepared by P. K. Whelpton are corrected for under-registration of births while the Detroit rates are not. Presumably under-registration in Detroit is very small.

A study of the rates for native-born white women shows a striking uniformity of pattern among the three sets both for All Women and Married Women. In both cases the Detroit rates lie below the United States rate and above the District of Columbia rates, (except at the one age group, 15–19, for Married Women). The District of Columbia rates are much below those for Detroit for All Women, but the two sets nearly coincide for Married Women. It appears probable that this difference is due to the considerable number of unmarried women government employees in the capital.

In the case of the foreign-born, a different picture is presented. Here, at the younger ages, the Detroit rates for All Women are much the highest of the three with the District of Columbia at the bottom, while for Married Women at the same ages the situation is completely reversed.[6] Apparently there is an unusually high percentage of early marriages among the Detroit foreign-born women. Beyond age 30 we find approximately the same patterns as were found for the native-born whites, with the United States rates the highest followed by Detroit and then the District. In the case of Married Women, the rates for all three groups almost coincide beyond age 25.

The Negro fertility rates run fairly true to form with like patterns exhibited among the three sets for All Women and also for Married Women. Again the United States rates are decidedly the highest, except at the age group 15–19, with Detroit somewhat above the District. As in the case of native-born whites, the greatest discrepancy between Detroit and the United States occurs in the later years for both All Women and Married Women, while it is just at these ages that the two urban rates most nearly agree.

To summarize, Detroit fertility rates are markedly below those for the nation except in the case of all foreign-born women between the ages of 15 and 30 where they are appreciably higher. The Detroit and District rates for all three groups of Married Women agree quite well, with Detroit slightly higher except at the age group 15–19. In the case of All Women, Detroit rates are uniformly much greater than those of the District for both white groups, and somewhat higher for Negroes.

Annual Fertility Rates for One-Year Age Groups: 1930 and 1920. Annual fertility rates for one-year age groups were prepared for both the 1920 and 1930 data by means of a mathematical graduation of the corresponding rates for the five-year age groups shown in Table 1. These rates were later used in the calculation of the net reproduction

[6] It should be noted, however, that there were only 344 foreign-born women aged 15–19 in the District of Columbia in 1930 and of these only 25 were married.

TABLE 3

GRADUATED ANNUAL FERTILITY RATES PER 1000 WOMEN BY ONE-YEAR AGE GROUPS; DETROIT, 1930 AND 1920

Age at last birthday	FERTILITY RATES 1930			FERTILITY RATES 1920		
	Native-born white	Foreign-born white	Negro	Native-born white	Foreign-born white	Negro
12	0	0	0	0	0	0
13	0	0	1.4	0	0	1.8
14	1.0	1.0	5.6	2.8	1.1	6.9
15	5.6	6.9	39.1	5.5	8.3	49.8
16	16.0	19.4	81.4	16.2	27.5	106.8
17	39.8	48.4	119.6	41.2	66.6	161.1
18	68.9	83.7	146.3	73.6	117.1	195.6
19	103.3	125.1	159.2	114.9	174.2	198.5
20	115.1	153.9	158.1	133.5	211.1	178.5
21	122.7	167.0	145.1	147.4	226.0	147.9
22	126.7	171.5	124.5	155.7	232.6	119.6
23	130.2	173.7	105.3	160.2	238.7	102.1
24	126.5	169.1	89.6	153.9	238.1	91.5
25	120.8	160.3	78.6	144.4	232.2	86.0
26	113.6	150.0	69.0	134.1	223.0	80.0
27	107.1	141.2	61.8	126.6	213.2	72.4
28	100.6	133.2	56.8	121.3	201.5	63.9
29	92.9	124.3	53.5	116.3	186.6	55.6
30	84.8	115.3	50.1	110.3	171.4	47.3
31	77.0	106.2	48.5	103.1	157.2	41.6
32	70.1	97.8	45.9	94.6	145.0	37.9
33	64.1	90.1	42.5	84.6	137.3	34.4
34	58.7	82.8	38.9	73.8	131.1	31.4
35	53.5	75.6	35.1	63.7	124.1	27.8
36	48.1	68.3	31.4	54.7	117.7	25.6
37	42.4	60.7	27.6	47.8	107.8	23.4
38	36.0	53.0	23.8	41.8	96.0	21.5
39	29.3	44.8	20.2	36.1	81.1	19.9
40	22.1	36.8	16.8	29.2	66.7	18.0
41	15.1	28.7	13.0	21.4	52.5	14.9
42	10.7	21.2	9.3	16.0	40.4	11.1
43	7.4	16.2	5.7	11.8	33.6	6.8
44	5.0	9.7	3.0	8.4	22.4	3.4
45	2.9	5.1	1.5	5.1	13.1	1.7
46	1.4	2.5	.6	2.4	6.7	.6
47	.6	1.1	0	1.1	3.1	0
48	.2	.2	0	.3	.5	0
49	0	0	0	0	0	0

rates for each of the racial groups in this study. The annual fertility rates for one-year age groups are shown in Table 3.

Net Reproduction Rates: 1930 and 1920. A "net reproduction rate"

is essentially the average number of female births which may be expected to occur to a newly-born female infant during her entire future lifetime, under the assumptions that fertility and mortality will continue to be correctly represented by the given tables. It is evident, then, that rates greater than, equal to, or less than unity imply populations which will ultimately be increasing, stationary, or decreasing, respectively.

The calculation of a net reproduction rate is made by multiplying the number of females existing at each age in a given mortality table by the appropriate annual fertility rate, thus obtaining the expected total number of children which would be born to a group of 100,000 female infants entering the life table at birth, during their entire respective lives. Dividing by 100,000 would therefore yield the expected number of children to be ultimately born to each female infant. Dividing this latter figure by 2.058 (the ratio of the total of both sexes born to girls born) results in the desired net reproduction rate.

The net reproduction rates for the native-born whites, foreign-born whites, and Negroes for both 1920 and 1930 are shown in Table 4. The

TABLE 4

NET REPRODUCTION RATES, DETROIT: 1930 AND 1920

Classification	1920 Rate	1930 Rate	Ratio 1930/1920
Native-born white.....	1.05	.86	.82
Foreign-born white....	1.75	1.17	.67
Negro.....	.79	.71	.90

life tables used, chosen after a comparison with actual Detroit mortality, were the two "1930 Urban Life Tables" for White Females and for Colored Females, prepared by the Metropolitan Life Insurance Company.

The net reproduction rate for 1930 for all white women of Detroit was computed to be .96, which is only slightly higher than the .93 found by Whelpton of the Scripps Foundation[7] and also found by B. D. Karpinos[8] by an indirect method. The Negro rate of .71 is slightly lower than the .74 found by Whelpton.[9]

That the fertility of the white women of Detroit is relatively high for so large a city may be seen by comparing its net reproduction rate with those calculated by Karpinos[10] for groups of cities of various sizes. This comparison is made in Table 5.

[7] Communicated to the authors in 1938.

[8] "Net Reproduction Rates for the White Population in Cities of 25,000 or more Inhabitants, 1930." *Population Index*, Vol. 4, No. 1, January, 1938. [9] *loc. cit.*

[10] "The Differential True Rates of Growth of the White Population in the United States and their Probable Effects on the General Growth of the Population," *American Journal of Sociology*, Vol. 44, No. 2, Sept. 1938, pp. 251–273.

TABLE 5

COMPARISON OF NET REPRODUCTION RATES FOR ALL WHITE WOMEN IN LOCALITIES OF VARIOUS SIZES

Residence	Rate
Detroit	.96
Cities over 100,000	.76
Cities of 50,000–100,000	.83
Cities of 25,000–50,000	.89
Cities of 2,500–25,000	.94
Urban United States	.84
Entire United States	1.08

Conclusion. The fertility of Detroit women has shown a decided decrease from 1920 to 1930, with the foreign-born women exhibiting the greatest proportionate decrease and the Negro women the least. Roughly, then, the decrease over the child-bearing period as a whole has varied with fertility. At the same time, within each of the white groups the decrease became more pronounced with advancing age, while there was no such apparent trend observed within the Negro group.

In both census years, the two white groups of All Women exhibited the same general fertility pattern which is markedly different than that of the Negro groups. This difference seems to be due principally to earlier marriage on the part of the Negroes. Fertility patterns for Married Women for all three groups in 1930 are much alike.

In comparing Detroit fertility with that of the nation, we find considerable similarity in all three groups both for All Women and Married Women, but at different levels, with the national rates decidedly higher almost everywhere.

A comparison with the District of Columbia (which is coextensive with the city of Washington, the only large city for which fertility rates were available) verifies the original assumption that fertility rates for the District for All Women are not applicable to Detroit. In the case of Married Women, however, the rates are remarkably close except for the groups aged 15–19 of foreign-born and Negro women, and here a paucity of exposures might make the District rates unreliable.

When this latter similarity of Detroit and Washington rates is considered in the light of the general economic and social dissimilarity between the two cities, one is tempted to suggest that fertility for married women within each racial group is more stable than one would expect. The only significant variable suggested by the data of this study is size of city of residence. This is brought out by the differences between large cities and the nation as a whole.

THE PENNSYLVANIA COMMITTEE ON STATE STATISTICS

By Harry Hoyle[1]

Since April 1939, the statisticians engaged in the work of the State Government in Pennsylvania have been conducting a voluntary program designed to improve the quality and scope of State Statistics in Pennsylvania. This work has been done under the auspices of the Harrisburg (Pa.) Chapter of the American Statistical Association which was formed in October 1938.

Unlike the Wisconsin Committee on Statistics, formed in March 1938 by official State action, the Pennsylvania Committee has always been considered a voluntary, unofficial effort on the part of the statisticians themselves to improve their own work. Soon after the organization of the Harrisburg Chapter, a need was recognized for some permanent body to collect and disseminate information on the activities of statisticians in the State Government, and to provide a reference group which could give advice on the sources of individual departmental statistics. To serve this need, the Pennsylvania Committee on State Statistics was organized in April 1939 by the American Statistical Association local chapter. The Committee was composed of five members all of whom were engaged in statistics in the major departments of the State Government. It included representatives from the Department of Labor and Industry, Department of Public Assistance, Department of Internal Affairs, Works Progress Administration and the State Planning Board. The writer was designated as chairman.

At its first meeting the committee undertook to define its functions and outline a program. The functions and program decided upon were as follows:

I. Publications of Interest to Statisticians.
   1. A Directory of State Statistical Agencies.
   2. A Source Book of State Statistics.

II. A Series of Programs to Acquaint State Statisticians with the Work in Other State Departments.

III. Reference Material on Sources of Statistical Information.

IV. Advisory Service on Statistical Standards and Methods.

[1] Harry Hoyle, Director, Standards Methods and Planning Section, Bureau of Employment and Unemployment Compensation, Commonwealth of Pennsylvania.

After this organization meeting, the Pennsylvania Committee on State Statistics set in motion plans to compile the "Directory of State Statistical Agencies." Questionnaires were circulated to all state agencies and departments asking for information on the personnel doing statistical work. A copy of this questionnaire is attached to this article. (Exhibit A) After the return of these questionnaires they were edited and rechecked. In October 1939 the Committee published the "Directory of State Statistical Agencies" and distributed it to all persons interested in this subject in Pennsylvania.[2]

Upon completion of this work, the committee had at hand useful information on the persons doing statistical work and some data on the types of work being done. With this material the committee stimulated and organized a series of Chapter Programs of the American Statistical Association in Harrisburg. The first of these programs was conducted by the Committee itself, and covered the work of the Committee and some material on the types of statistical work being done in the State Government. Subsequent programs were conducted on the statistical work of individual state departments. For example, programs have been conducted on the work of the Department of Public Assistance, Department of Internal Affairs, Department of Welfare, Bureau of Employment and Unemployment Compensation, etc. It was found that these meetings were very stimulating in acquainting statisticians with the types of work being done, the figures available, and the gaps which exist in statistical information. Also certain valuable suggestions were offered at these meetings for the consideration of the department presenting the program.

At the same time, the Pennsylvania Committee on State Statistics undertook to gather a source book of information on statistical data maintained by various branches of the State Government. For this purpose a questionnaire was designed and sent to all statisticians in government work. Individual forms were filled out for each statistical series. A copy of this questionnaire is attached and labeled Exhibit B. At the present time (September 1940) the material for this source book is collected and is being edited. It is expected that this source book will contain descriptions of the nature and content of several hundred statistical series being maintained in the State Departments in Pennsylvania. This reference book entitled "Source Book of State Statistics in Pennsylvania," will, we think, be a valuable working tool for

[2] A limited number of copies are available for other interested persons upon application to the Committee on State Statistics, American Statistical Association, Harrisburg (Pa.) Chapter, c/o Pennsylvania State Planning Board, Capitol Bldg., Harrisburg, Pennsylvania.

statisticians who require the use of many statistical series and data in their daily work.

All of the material collected for compiling the "Directory of State Statistical Agencies" and the "Source Book of State Statistics" has been filed with the State Planning Board in Pennsylvania. This Board has organized the material on reference cards and, with the cooperation of the statisticians, is attempting to keep the material current. It is planned that the material in these two booklets will be revised, from time to time, and reissued. At any time, however, individual statisticians desiring further information on either statistical personnel or statistical series can secure such data from the State Planning Board. It is expected that this Board will become a central source of statistical information, and that the Pennsylvania Committee on State Statistics will assist in keeping this information current.

Mention has already been made of the programs conducted by the Pennsylvania Committee to acquaint state statisticians with the types of work being done. Experience has shown that, from time to time, individual statisticians are calling upon this Committee or its members for advice on statistical projects. A significant number of statisticians in government work in Pennsylvania are clearing their statistical projects, voluntarily, with this Committee. While no formal staff, other than the Committee itself, has been set up, advice is freely given by the Committee.

This experience in voluntary cooperation of state statisticians for the improvement of state statistical work has shown sufficient vigor to be considered a successful beginning. While progress is slow, the essential ground work has been laid for a program with the participation of practically all state statisticians. Some sixty statisticians participate in the Pennsylvania program regularly.

From time to time suggestions have been received that the voluntary effort being conducted by Pennsylvania statisticians should be formalized by the creation of a Central Statistical Board for the State. This Board would have compulsory powers to require clearance and approval of statistical projects and standards. It is the belief of the writer that the voluntary method now in vogue in Pennsylvania will be continued in preference to the creation of an official Board. The Pennsylvania program is carried on without interference from budgetary crises or official policy. Cooperation has been secured from all State Department Officials and Statisticians without qualification. It is the feeling in Pennsylvania that this progress should not be jeopardized by the tides and turns of official policy and financial crises. We expect to continue this progress which has made a worthwhile beginning.

Return Completed Blank To	*STATISTICAL DATA SOURCE BOOK* (Reporting Blank)	State Statistical Committee Pa. State Planning Board 928 N. 3rd Street

1. *Identification*

1.1 Name or official designation of series.....

1.2 Maintained by what agency?.....

1.3 Collected for what time units?.....

1.31 ☐ Week 1.33 ☐ Year

1.32 ☐ Month 1.34 ☐ Other.....

1.4 Series extends from date..... To date.....

1.5 Series uses what breakdowns?

1.51 Area

1.511 ☐ School District 1.515 ☐ County

1.512 ☐ Borough 1.516 ☐ State

1.513 ☐ Township 1.517 ☐ Other.....

1.514 ☐ City

1.52 Other breakdowns.....

2. *Issue*

2.1 How Issued?

2.11 At what intervals?

2.111 ☐ Weekly 2.114 ☐ Occasional

2.112 ☐ Monthly 2.115 ☐ On Request

2.113 ☐ Yearly 2.116 ☐ Other.....

2.12 How soon after incidence of data?.....

2.12 How procurable?

2.131 ☐ Mailing List 2.134 ☐ Other.....

2.132 ☐ On written request 2.135 ☐ Charge.....

2.133 ☐ By phone

2.2 Form of Issue:

2.21 ☐ General Bulletin 2.23 ☐ Special Release

2.22 ☐ Administrative Report 2.23 ☐ Other.....

3. *Nature and Use*

3.1 Is Series Maintained for:

3.11 ☐ Administrative Routine 3.13 ☐ General Information

3.12 ☐ Research Purposes 3.14 ☐ Other.....

3.2 Is Series Based on:

3.21 ☐ Actual Contacts 3.25 ☐ Index Numbers

3.22 ☐ Sampling 3.26 ☐ Percentages or Ratios

3.23 ☐ Estimates 3.27 ☐ Other.....

3.24 ☐ Averages 3.28 Is Series Adjusted: ☐ Yes ☐ No. How.....

3.3 Method of Presentation:

3.31 ☐ Tabular 3.33 ☐ Interpretative Text

3.32 ☐ Graphic 3.34 ☐ Other.....

Signature (Supply on 1st page)..... Official Title.....

Agency.....

Information given as of date..... 19.... Page.....of.....Pages

Fill out one form for each series

To Statistical Directors

In order to assist in compiling an up-to-date and authentic directory of State Statistical agencies and personnel, will you please fill out the following form and return to—*Committee on State Statistics, Harry Hoyle, Chairman, 218 South Second Street, Harrisburg.*

American Statistical Association
Harrisburg (Pa.) Chapter
Committee on State Statistics

Form 1.

For Government Agencies Doing Statistical Work

1. Name of Agency.....
2. Bureau, Division, Section, or Unit doing statistical work:

   A. Name.....

   B. Name of Head..... Title.....

   C. Address: Building, or Street..... Room City..... Telephone.....

3. Indicate whether: Federal ☐ State ☐ Local ☐ If other, specify.....
4. General Field in which Statistical Work is Done.....
   (Education, Labor, Public Works, etc.)
   .....
5. Types of Statistical Work Done: Collection ☐ Tabulation ☐ Reporting ☐ Analysis ☐

   Signature of Head of Bureau, Division, Section, or Unit.....

If Subordinate Persons in Charge of Special Work Should Be Listed in Directory Please Show Below

Name	Title	Type of Work	Room	Building or Address	Tele. No.

A GRAPHIC SHORT CUT TO THE MOVING AVERAGE METHOD OF MEASURING SEASONALITY

By William A. Spurr
University of Nebraska

The standard method of measuring seasonality by averaging ratios to 13-month moving averages[1] has one prime defect—its laboriousness. In 1937 the writer suggested an analogous all graphic method[2] but this short cut is open to the criticism that it involves two subjective steps.[3] For those who prefer the objective 13-month moving average method, therefore, the following time-saving procedure is offered. Labor is saved by substituting graphic measurement for machine calculation in steps 3 to 5 and 7 below, and by obviating the use of tables for computation. Other steps are identical. Clerical labor may be used throughout. The only error involved—that of reading the chart—is believed to be negligible since it averages little over 0.1 per cent[4] (see table below) whereas seasonal indexes are ordinarily accurate only to the nearest 1.0 per cent. The steps are:

1. Chart the series, preferably on one-cycle semi-logarithmic paper to permit large scale ratio analysis.

2. Compute 12-month moving totals by adding machine, as in the usual method.

3. Plot the moving totals directly from the adding machine tape on the chart in red (multiplying scale values by 10), centering each one horizontally between its two middle months. That is, the first calendar year's total is plotted midway between June and July, and so on. The curve is thus a fractional inch, or 20 per cent, above where a centered moving average would be.[5] This obviates computing a two-item moving total of the 12-month totals as well as the transcription of totals from the adding machine tape to a table for further calculation.

4. Fold an extra piece of the ratio paper into 12 vertical strips, labeling them "Jan." to "Dec." Now mark a percentage scale on the vertical axis, with 100 per cent near its center, and draw a red line horizontally

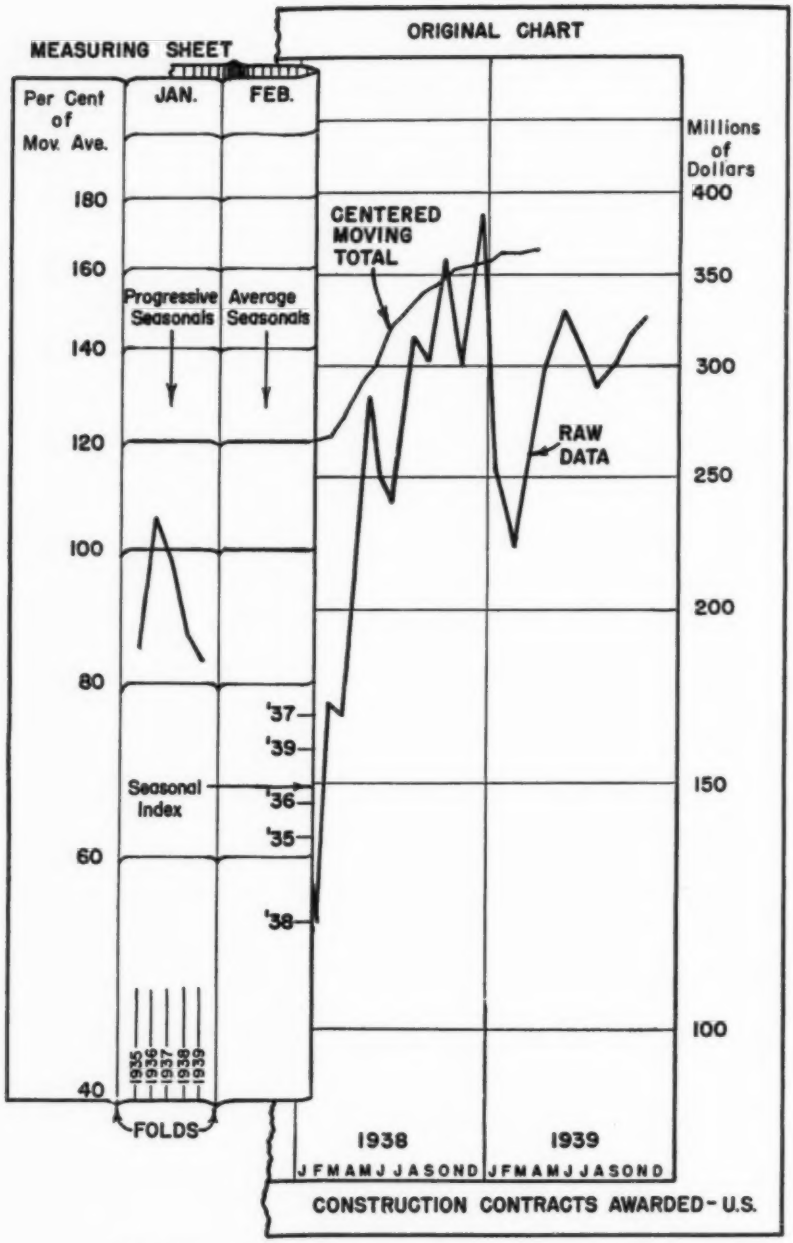
[1] Croxton, F. E. and D. J. Cowden, *Applied General Statistics* (New York: Prentice-Hall, 1939), pp. 471–484.

[2] This Journal, "A Graphic Method of Measuring Seasonal Variation," Vol. 32 (June, 1937), pp. 281–9. The all-graphic method is, of course, shorter than the one described here.

[3] The drawing of the trend-cycle curve and the averaging of monthly arrays.

[4] This order of error is for 10-inch one-cycle ratio paper (such as Keuffel and Esser 358–50), and equals that of a 10-inch slide rule. The error varies with the number of cycles. In the seasonal index, however, the error decreases roughly with the square root of the number of constituent values.

[5] If it is desired to apply a free-hand correction to the moving average, as in the Federal Reserve Board method (*Federal Reserve Bulletin*, Dec. 1936), the moving totals should be lowered by means of two marks on a paper strip the distance between 120 and 100 per cent and plotted as moving averages on the original scale for free-hand adjustment. In this case the center line on the folded sheet (step 4) should be drawn at 100 instead of 120 per cent.



MEASURING SEASONAL VARIATION FOR FEBRUARY 1938

along the 120 per cent line. Place the edge of the January strip (with the other months folded under) on the chart with the red 120 per cent line on the red moving total curve midway between two of its points, directly above the first original January value. Mark this point on the strip, and label it with its year. Then move the strip along to mark each of the other Januaries, always keeping the red lines together. Fold the sheet to mark the remaining months on their respective panels. The result is illustrated under "Feb." in the chart.

This step eliminates both the multiplication of centered moving totals by 1/24 to arrive at moving averages (through placing the base line at 120 per cent), and the division of original data by these averages (through marking vertical distances on the ratio strips). The unfolded sheet also provides a diagram of the 12 monthly arrays, so that a separate one need not be made, for use in gauging the significance of seasonality or in selecting the number of middle items to be averaged.

5. Read off from the scale of the measuring sheet the values of the monthly items to be averaged, enter them directly on an adding machine (or list them on the sheet), and total by months.[6] Add the 12 totals.

6. Multiply each total by the ratio of 1,200 to the sum of the 12 totals in order to average each month's ratios to moving averages and to adjust the 12 preliminary seasonal indexes to average 100 per cent.

7. To adjust the series for seasonal variation, plot the seasonal indexes on the measuring strips, place each index on the original monthly points of the chart and mark the adjusted values opposite the 100 per cent line of the measuring sheet. This obviates division by seasonal indexes and replotting the deseasonalized values.

Progressive seasonality may be measured in the same way by marking the years across the bottom of each panel of the measuring sheet and laying off a month's positions in successive years in the appropriate columns as shown under "Jan." The 12 monthly diagrams which thus appear on the measuring sheet may then be smoothed by moving averages or otherwise as in the usual methods, and the preliminary seasonal indexes read from the smoothed curve for correction to average 100 per cent in each year. Adjustment of original data for seasonality then proceeds as above.

Methods of averaging ratios to other bases such as secular trend ordinates, annual averages, or preceding month's values (link-relatives) may be shortened similarly by marking the monthly ratios on a 12-

[6] Totals of successively increasing numbers of middle items may be secured by starting with the middle one or two items, and sub-totaling after adding each additional pair, if it is desired to select seasonal indexes from varying concentrations of modified means.

panel grid sheet. Weekly or quarterly data may of course be treated in the same way as monthly series.

The average computing time and error of the graphic short cut, as compared with the standard method, is shown below, using six-year segments of three diverse series—construction contracts, department store sales, and a theoretical sequence[7]—computed by three N.Y.A. students.

Method	Computing and checking time (minutes)	Error of seasonal indexes (per cent)	
		Average	Maximum
13-month moving averages	195[8]	0[10]	0[10]
12-month moving averages	175[9]	0.3	0.7
Graphic short cut	110	0.1	0.4

The time saving—about 44 per cent—would be greater if adjustment for seasonality (step 7) were included, but less if the averaging of moving totals were omitted in the standard method. The graphic error is less than that of averaging ratios to 12-month averages centered on the seventh month, which is also shown for comparison.

[7] See *Annals of Mathematical Statistics*, Vol. I (1930), pp. 57–72, 345–351.

[8] Includes computation of centered moving totals, multiplication by 1/24, division of data by moving averages, plotting seasonal diagrams and final adjustments. Original charting time is excluded in all cases.

[9] Includes same steps as above except centering moving totals.

[10] This method is used as standard.

THE CALCULATION OF CORRELATION COEFFICIENTS FROM UNGROUPED DATA WITH MODERN CALCULATING MACHINES

By P. S. Dwyer
University of Michigan

The choice of a preferred method of calculating a given statistical coefficient should be made with some regard to the mechanical equipment available. Some of the most popular methods involve grouping the data and transforming the variable to a new variable measured in units of one class interval from some class chosen as the origin. This method is very useful since it reduces the problem to one involving small numbers. It is very desirable when no computing machine, or at best a crude one, is available. The successive improvements of the calculating machine have eliminated the necessity of using these devices since the machines are now, in many cases, capable of handling the original data without grouping. The elimination of the necessity of grouping is of theoretical as well as of practical importance for, in addition to saving the time and effort spent in making frequency distributions and correlation charts, it eliminates the error due to grouping. This is true in calculating standard deviations, correlation coefficients, and sums of squares for the analysis of variance.

The technique which uses the calculating machine and ungrouped data in getting Σx, Σy, Σx^2, $2\Sigma xy$, and Σy^2 simultaneously for correlation coefficients is well known. It can be used with almost any calculating machine but its advantages are greatest with the modern fully automatic models. A ten place machine should be used if three place accuracy is desired but an eight place machine can be used if the numbers are two digit numbers. Early descriptions of this method have been given by Tremmel and Weidemann[1] and Constance.[2] The values of one variable, x, are multiplied by 10,000 or 100,000 or some other suitable power of 10 and are added to the corresponding values of the other variable, y. The resulting numbers are entered on the keyboard and multiplied by themselves (squared). The dials are not cleared after each multiplication; they accumulate Σx and Σy in the multiplier dial and Σx^2, $2\Sigma xy$, and Σy^2 in the product dial. These quantities appear separated in the dials if a power of 10 has been used which keeps x and y well separated on the keyboard but does not spread them beyond the capacity of the machine. In effect this divides the keyboard and multi-

[1] E. E. Tremmel and C. C. Weidemann. *A machine method of calculating the Pearson correlation coefficient.* University of Nebraska Extension Division, Lincoln, Nebraska, 1930.

[2] Clifford L. Constance. "Correlation by calculating-machine." *Journal of Experimental Psychology*, 15 (1932), 458–464.

plier dial into two fields. The product dial is divided into three fields.

Improvements have been made on the standard computing machines during recent years. The technique can be performed efficiently on the latest Fridén, Marchant, and Monroe models. Each has its advantages and drawbacks so that some will prefer one, some another, of these machines.

The Monroe Company offers one unique feature with deserves mention. Its fully automatic model A1 uses the same keyboard to set first the multiplier and then the multiplicand. This model can be equipped with a switch, placed to the right of the keyboard, which can be set so that the keyboard keys are not released when the multiplier set up bar is depressed. It is then only necessary to complete the operation by depressing the automatic multiplying bar. The next number pair is punched in the appropriate fields, the bars are depressed, and the cumulations obtained. With this attachment it is apparent that the desired products can be found from a single punching of the numbers on the keyboard. This not only cuts down the amount of work done by the operator but tends to eliminate computational errors since these are more apt to enter during the second key punching operation. This technique is easily accomplished with the right hand on the machine and the left on the manuscript, or vice versa.

The statement of the first paragraph that this method eliminates grouping is true in the general rather than the strict sense. With a ten place machine it is possible to obtain products of numbers involving one, two, or three digits without grouping. If numbers using more than three digits are involved, the grouping process consists simply in rounding off to the first three digits. Such a grouping system makes possible, in the language of more formal grouping, a maximum of a thousand class intervals.

If numbers using one or two digits are involved, it is best to use the six right columns of keys for y and the four left columns for x. If three digit numbers appear, it is best to use a 3–7 breakdown. If one variable has two digits and a second has three digits it is best to use a 3–7 breakdown with the three digit variable on the right. The difficulty with the 3–7 breakdown is that the value Σx in the upper dial records to the last three digits only as soon as its value is greater than 1000 because of inadequate carry over. In such a case the values of x and y can be interchanged in making the check run so as to find the missing digits.

The technique can be used not only to replace hand grouping methods but also to replace some of the work which has previously been done on Hollerith machines. If the number of variables is large and the

number of cases large, Hollerith machines are still indicated but it appears it is more economical to use the specially equipped Monroe for determining the intercorrelations of up to four variables and up to 250 cases. Of course this technique is advised for a larger number of variables and a larger number of cases if Hollerith equipment is not available.

In the case of a two variable problem it is wise to recalculate the desired quantities for purposes of checking. In the case of more than two variables, however, the successive runs can be used to check the previous ones. In a three variable problem we make the successive runs x_1 with x_2, x_1 with x_3, x_2 with x_3. The values of Σx_1 and Σx_1^2 in the first and second runs should check, the values of Σx_2 and Σx_2^2 in the first and third runs should check, the values of Σx_3 and Σx_3^2 in the second and third runs should check. If these all check, the products need not be recalculated. In the case of a four variable problem, there will be six runs and the values Σx_i and Σx_i^2 will be obtained three times. In an n variable problem there will be $\frac{1}{2}n(n-1)$ runs and the values Σx_i and Σx_i^2 will be obtained $n-1$ times.

The quantities can also be computed with the modern automatic Marchant or Fridén though it is necessary to punch the number pairs as multiplicands and again as multipliers. The automatic multiplication on the Marchant has been greatly speeded up and the depression of the multiplier keys completes the multiplication so it is not necessary to press additional bars. On the Fridén one can set both multiplier and multiplicand, then check the settings before depressing the multiplication bar.

A similar technique can be used in calculating Σx and Σx^2, quantities which are needed to determine the standard deviation from ungrouped data.

STATISTICAL NEWS AND NOTES

Division of Statistical Standards, Bureau of the Budget
(Formerly Central Statistical Board)

On August 27, the President appointed an Advisory Committee on Selective Service "to work with the Joint Army and Navy Selective Service Committee in planning the procurement of man power for our National Defense." Members of the Advisory Committee are: Mr. Frederick Osborn, Consultant in the Division of Statistical Standards, Bureau of the Budget, Chairman; Col. William H. Draper, Jr., War Department; Mr. Floyd W. Reeves, Executive Assistant for Labor Supply to Mr. Sidney Hillman of the National Defense Advisory Commission; Mr. Joseph P. Harris, Special Assistant to the Secretary of the National Defense Advisory Commission; Mr. Wayne Coy, Assistant Administrator, Federal Security Agency; and Mr. Channing W. Tobias, of the National Council of the Y.M.C.A. Mr. Elbridge Sibley, Division of Statistical Standards, Bureau of the Budget, is serving as Secretary of the Committee. The Committee has been in almost continuous session considering questions of policy and procedure relating to selective service, and members of the Division's staff have been assisting in the preparation of forms, in connection with their regular tasks of clearance and review.

The United States chapter of the *Inter-American Statistical Compendium*, entitled "Statistical Services and Activities of the United States," which was prepared by the Central Statistical Board for the Statistical Section of the Eighth American Scientific Congress, has been reproduced as a separate volume. It contains 23 sections, each prepared by a recognized expert in an important field of statistical information. Each author discussed the present character of statistics in his field, the recent developments in these data, and the additions and improvements still needed. The Compendium, with chapters for each of 22 American nations, will be published during the early winter. A limited number of copies of the United States chapter are now available upon request.

The Division of Statistical Standards recently distributed to Federal and other public agencies and private organizations throughout the country more than 3,000 copies of a statement urging that agencies, which are establishing occupational surveys and training or placement programs, adopt either the Dictionary of Occupational Titles of the Bureau of Employment Security or the Occupational and Industrial Classifications of the Bureau of the Census, depending upon the particular occupational classification problem with which a project is faced. Statistics arising out of either classification system can be converted to the other system by means of the Convertibility List of Occupations prepared by the Joint Committee on Occupational Classification of the American Statistical Association and the Division of Statistical Standards. Anyone interested in seeing the statement may secure a copy from the Division.

Bureau of Research and Statistics, the Advisory Commission to the Council of National Defense

The Bureau of Research and Statistics was established June 20, 1940, for the purpose of centralizing the statistical work of the Defense Commission. Its Director is Stacy May, formerly Assistant Director for the Social Sciences of the Rockefeller Foundation. With a few exceptions, members of the Bureau's staff have been recruited from other branches of the Government service, thus insuring a personnel with an excellent knowledge of Government activities and procedures, and one which can secure effective cooperation from the other Government agencies.

The functions of the Bureau may be summarized as follows:

(1) To secure from Army and Navy records such statistical information on appropriation authorizations, military requirements, and contracts let as may be required by the various offices of the Commission, setting up this information in the most desirable form and correlating it with other information for the use of the Commission.

(2) To serve as a liaison office between the various divisions of the Commission and other Government agencies on all problems involving the use of the facilities of other agencies.

(3) To provide a centralized drafting and statistical pool for the use of the several divisions of the Commission.

(4) To provide library service to all offices of the Commission.

(5) To handle spot informational requests from all offices of the Commission.

(6) To conduct by means of its own facilities, or, when an existing Government agency has adequate facilities, to arrange for that agency to conduct such regular or special statistical surveys as may be required by the Commission.

The Bureau is organized into nine divisions whose designations and activities are outlined below:

Operations Control. Acts as assistant to the Director. Makes assignments to the staff of requests for services of the Bureau. Clears completed reports before submission to the Commissioners.

Program Progress. Develops and maintains a record of progress on all aspects of Defense Commission work. Prepares weekly report for information and guidance of the Commission.

Industrial Capacity. Currently handles all requests from the Commission for economic surveys of situation in particular industries or commodities. Responsible for developing and integrating broad studies of capacities, labor, plant, transportation, power, etc.

Consumption Problems. Analyzes civilian needs in relation to defense requirements and changes in national income and consumption resulting from the Defense Program.

Military Requirements. Develops from Army-Navy files and from outside sources, the military requirements month by month in terms of items, components and materials.

Civilian Requirements. Develops from Army-Navy files and from outside sources, the civilian requirements month by month in terms of finished products and materials.

Statistics and Information. Handles all requests for spot information. Undertakes special statistical surveys. Develops current statistical record books and chart books for use of the various offices of the Commission. Provides current analysis of the business situation and outlook. Provides library service to all offices of the Commission.

Plant Location. At the request of the Army, the Navy, or the Commissioners, develops objective measurements of the relative merits of proposed sites according to criteria named by those framing the requests. Further seeks to develop general background material to facilitate selection of sites.

Office Management. Handles all housekeeping functions and supervises the drafting room and statistical pool.

National Roster of Statisticians

The National Roster of Statisticians is one part of the project entitled, National Roster of Scientific and Specialized Personnel. Its purpose is to establish a central file of highly competent individuals in the field of sta tistics in order that the services of those persons can readily be made available for purposes of national defense.

The program as carried out is jointly administered by the National Resources Planning Board and the United States Civil Service Commission by commission of the Executive Office of the President. These two agencies have designated Dr. Leonard Carmichael, President of Tufts College, and Mr. James C. O'Brien, an executive of the Civil Service Commission, to administer the program. The joint administrative agencies will have their efforts supplemented by the National Research Council, the Social Science Research Council, the American Council on Education, and the American Council of Learned Societies. These groups will act in an advisory capacity and will provide scientific and technical consultative service to the staff of the Roster. To date, the extent of such service has been assistance in the development of technical check lists prepared for each individual field of scientific specialization, consisting of a breakdown to a rather fine degree of the essential specializations accruing under the more general fields of scientific activity. Such a check list will have been received, along with the more general questionnaire, by the membership of the American Statistical Association and others.

The information so gathered by this circularization will be coded by the staff of the National Roster in the Washington office, and will be transposed to punch cards, in order that all significant information may be readily available in this form. These cards will be filed according to the various specialized fields which are being covered in this comprehensive survey. Thus, if there arises a need for specialists in some particular statistical field endeavor, the Roster can readily locate qualified individuals by sorting the punch cards classified under specific fields, and select those individuals who

possess the particular pattern of qualifications required for the immediate need. The adaptation of mechanical methods in the selection process will definitely provide a rapid means of selection and should considerably speed up the process all along the line. In connection with this, however, it must be recognized that certain factors, from the selection standpoint, cannot be reduced to a code which lends itself to machine methods. The particular considerations involved here would relate primarily to the various degrees of competency possessed by individuals in a particular group so selected. In order to accomplish this phase of the selection process, the scientific societies cooperating with the Roster shall provide evaluation committees to whom shall be referred the names and backgrounds of individuals selected for a particular assignment. Thus, recognition is given, not only to the factual information which can readily be ascertained through the machine-sorting process, but also to the intangible qualitative character of each individual's experience and background. It is hoped that this technique will insure an intelligent determination of competencies of various individuals who may be thus selected.

It is understood that one of the primary objectives of the Roster, and one equally as important as the provision for a source of highly qualified individuals, is the conservation aspect of the program. It is apparent that much work is being done outside of the Government service which has a direct relationship to the defense program. In many instances this work should not be disturbed by the withdrawal of individuals for Federal service because in so doing, the ultimate interests of the Government might be detrimentally affected rather than helped. The Federal Government has never before sought to set up a central register of the country's human resources in the scientific and specialized fields. This project is an important undertaking and will result in valuable information not hitherto available.

Dominion Bureau of Statistics, Canada

Demography. Volume I of the Alberta Census of 1936 has been published. It deals with population and agriculture, and extends to 1276 pages.

Internal Trade Statistics. Publication was commenced in September, 1940, of a new cost of living index for Canada. This index replaced the Bureau's old series on the base 1926 = 100. Both the Department of Labour and the Wartime Prices and Trade Board were consulted regarding methods of construction and the new index is to be considered official for Canada. The base period 1935–1939 = 100 has been adopted. As mentioned in a previous note to this JOURNAL, the index will measure changes in living costs of urban wage-earner families.

Education Statistics. Dr. R. W. B. Jackson, of the Ontario College of Education, has been working in the Bureau during the summer months, assisting in the development of a plan for obtaining more satisfactory annual records of personnel from the schools. The problem is one of devising standard questions and forms which will meet the needs of all nine provincial Departments of Education. Mr. J. A. Christie, Accountant of the Vancouver

School Board, has been doing similarly with financial reports of school districts.

Judicial Statistics. Details of appeals of non-indictable offences, handled by County Courts, have been collected and statistics of such appeals and their dispositions are being published in the 1939 *Report of Criminal Statistics.* These tables complete statistics of all appeals of Criminal Cases in Canada.

National Income. The first phase of the compilation of the national income in process for three years was recently completed. The three-way distribution by productive sources, income payments, and provinces furnishes considerable information regarding the operations of the Canadian economic system. A report giving the general results for the period since the termination of the last war will be published shortly.

Division of Tax Research, United States Treasury Department

During the period July through September 1940 the Division of Tax Research of the Treasury Department published one of its studies in the *Bulletin of the Treasury Department.* The July 1940 issue contained an analysis of the size and industrial distributions of partnerships in 1936 as it came from Federal income tax returns. The study was sponsored and directed by the Division of Tax Research and financed by funds allocated to the Treasury Department under authorization of the Commissioner of Work Projects.

The Income Tax Study project in Philadelphia, conducted under the supervision of this Division with funds transferred from the Work Projects Administration, which was outlined on page 371 of the June 1939 issue of this JOURNAL and on page 131 of the March 1940 issue, has been continued until November 30, 1940. In addition to the study of income tax returns originally planned, analysis is also being made of estate tax and excess-profits tax statistics.

Board of Governors of the Federal Reserve System

There were published in the *Federal Reserve Bulletin* for September 1940 tables of the gold reserves of central banks and governments in most of the countries of the world, presenting annual figures from 1913 to 1927 inclusive and monthly figures from June 1928 through April 1940. Certain revisions were effected in the figures previously published, while the reported gold holdings of Iran and Venezuela were included for the first time. The tables were accompanied by a tabulation describing the sources and nature of the data for each country, and by an explanatory text containing a summary of the official information available concerning special government gold reserves which were not included in the regular tables. Special attention was directed to the increasing inadequacy of the regularly reported figures, a tendency which has been accentuated since April 1940 by the uncertainties surrounding the fate of the gold reserves of the European countries occupied by Germany and Russia.

A chart book showing the Board's new index of industrial production together with 33 groups and 81 individual series has been prepared. Each of the 115 charts shows indexes both without seasonal adjustment and adjusted for seasonal variation, covering the period for which data are available. Indexes from 1923 to date were published in the *Federal Reserve Bulletin* for August 1940, along with a description of the new index. Reprints of this material and also of an article in the September *Bulletin* on "Measurement of Production" are now available. At a later date a detailed account of the problems encountered and methods used in deriving each of the series and combining them into group indexes will be distributed to those interested.

A complete revision of the Federal Reserve general chart book on bank credit, money rates, and business is now in process, and the new book will be available early in 1941. Old charts are being materially revised, and new charts are being added. Space with lightly printed grids for data for 1941 and 1942 will be included. The book as usual will contain a list of sources for all past figures, and the *Federal Reserve Bulletin* will continue regularly to have a table with data for bringing the charts up to date. The chart book again will be of brief-case size. It will be sold at a price to cover the cost of paper and printing.

United States Department of Agriculture

Long-range weather forecasts. Under a recently completed agreement between the University of Chicago and the Agricultural Marketing Service of the United States Department of Agriculture, work is starting on a cooperative project entitled, "An Investigation of the General Circulation of the Atmosphere, Including a Study of Extra-Terrestial Influences to Determine the Scientific Basis for Long-Range Weather Forecasts." The Division of Agricultural Statistics is actively supervising the participation of the Agricultural Marketing Service. The University of Chicago will contribute scientific leadership and direction. The United States Department of Agriculture will contribute scientific participation in planning and direction and will administer the project, which is conducted with Bankhead-Jones funds allotted to the Agricultural Marketing Service and with funds made available at the University of Chicago.

The work will be carried on in the newly organized Meteorological Institute of the Physics Department at the University of Chicago. Dr. Horace R. Byers, head of the Institute, and Dr. Arthur H. Compton, head of the Physics Department, are participating in the project. Other personnel includes Dr. Harry Wexler and Mr. Victor B. Starr, who will be actively engaged in the meteorological aspects of the project, together with Dr. Horace W. Norton and Mr. Glenn W. Brier, who will devote their attention to statistical problems arising in the research.

The project supplements other projects on long-range weather and crop forecasting that have been conducted cooperatively between the Agricultural Marketing Service, Weather Bureau, Bureau of Plant Industry, Soil

Conservation Service, and various colleges, universities, and experiment stations and a project on research in the statistics of agriculture and the associated statistical theory conducted cooperatively by the Agricultural Marketing Service and the Statistical Laboratory at Iowa State College.

Recent publications dealing with results from these research projects are "Reports on Critical Studies of Methods of Long-Range Weather Forecasting" issued by the Weather Bureau as Supplement No. 39 of the *Monthly Weather Review* and "An Experiment in Pre-Harvest Sampling of Wheat Fields" by Arnold J. King and Emil H. Jebe, issued as *Research Bulletin* 273 by Iowa State College, together with a number of papers in various technical journals.

As a result of studies in long-range weather forecasting conducted cooperatively with the Massachusetts Institute of Technology under these projects, the Weather Bureau is now issuing 5-day weather forecasts as part of its regular service to the public.

Statistics for standardizing garments and patterns. The Bureau of Home Economics in cooperation with the Work Projects Administration has completed a study on "Women's Body Measurements for Standardizing Garments and Patterns." The statistical results of this study will be published soon by the United States Department of Agriculture.

United States Tariff Commission

The Tariff Commission has recently issued additional parts of its report on "Trade of Latin America with the World and with the United States." Part I, which is concerned with the trade of Latin America as a whole, was released several months ago, and was translated into Spanish for use at the Habana Conference.

Each section of the second part of the report contains a brief description of the physical characteristics, population, natural resources, and industries of a particular Latin American country, its commercial policies, the trend, composition, and destination of its exports, and the trend, composition, and source of its imports. Each section also contains an analysis of United States trade with the country. Sections issued to date apply to Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, and Venezuela; the remaining sections will be available soon.

Part III is issued in two volumes and contains a series of digests of information on 30 important Latin American export commodities which account for by far the major portion of the value of all Latin American exports. For each commodity there is a discussion of the relative position of Latin America in world production, exports from Latin America, trade barriers, competitive conditions and prices, and the effects of the European war. Statistics of total exports from each important producing country and of exports to principal markets in specified years, 1929 to 1938, are shown, as well as statistics of production when available.

Bureau of Statistics, Interstate Commerce Commission

Issue of a new quarterly statistical series will begin shortly to show the number of tons of freight originated and the number terminated in carloads in each state, except that New England will be treated as a whole.

The Railway Express Agency has filed with the Interstate Commerce Commission tables giving an analysis of its traffic and revenue to show the effect of rate changes made in 1939.

Bureau of Foreign and Domestic Commerce

In cooperation with the Wage and Hour Division of the Department of Labor, the Bureau has undertaken a study of the effects of the Wage and Hour law on the operations of wholesalers. This study has been initiated at the instance of the wholesale food trades. A questionnaire survey has been planned and the schedules were mailed in the middle of October to some 5,000 concerns in the food field. Statistics will be secured for analytical purposes on volume of sales, operating expenses, and pay-roll cost for full time and part time employees covered by the Act. Data also will be obtained with respect to measures that may have been taken to adjust operations to conform with the Act.

The Marketing Research Division of the Bureau will collect and tabulate the data, and prepare the statistical tables. These tables will be turned over to the Wage and Hour Division of the Department of Labor for analysis and preparation of a report, with any appropriate recommendations. The statistics likewise will be made available to cooperators and interested parties.

The National Income Division has begun work on estimates of the national income in terms of final products. This work is an extension of the studies undertaken by the National Bureau of Economic Research and published in part in *Commodity Flow and Capital Formation*, Volume I. The publication of results will not be undertaken for at least a year.

Progress on the monthly industry survey, undertaken by the Division of Business Review at the end of 1939, has permitted the issuance of monthly indexes of manufacturers' inventories, shipments, and new orders. Reprints of the article presenting the results, the sample and methodology are available from the Division upon request.

Bureau of Labor Statistics, U. S. Department of Labor

Changes in Organization of the Bureau of Labor Statistics. The position of assistant commissioner of the Bureau of Labor Statistics has been filled by the appointment of A. F. Hinrichs, formerly chief economist. The various operating divisions have been grouped as three branches. Donald H. Davenport, formerly on the faculty of the Harvard University Graduate School of Business Administration, is chief of the Employment and Occupational Outlook Branch. The Prices and Cost of Living Branch is under the supervision of Aryness Joy, and N. A. Tolles is chief of the Working Conditions and Industrial Relations Branch.

Under the reorganization, S. W. Wilcox continues to serve as chief statistician, Hugh S. Hanna as chief of the Editorial and Research Division, and Henry J. Fitzgerald as chief of the Business Management Branch.

Prices and Cost of Living. A study of prices of building materials, made by the Wholesale Price Division of the Bureau and the T.N.E.C. Studies Section, is nearing completion and is to be published shortly as a T.N.E.C. monograph. The study covers the prices of 42 building material items in 50 localities, obtained quarterly from 1935 to date. Two price series are included: producers' or manufacturers' prices to distributors or dealers, and dealers' or distributors' prices to typical contractors doing a medium-sized volume of business. Actual prices and index numbers will be shown for each of nine geographic regions, and for each item there will be a discussion of the pricing and marketing structure. The Bureau plans, for the present, to continue pricing these items currently.

Wholesale prices for lumber and carpets and rugs have been revised and introduced into the general index. Mimeographed reports describing the revision and presenting the improved prices, from 1935 for lumber and from 1933 for carpets and rugs, are available upon request to the Bureau. The revision represents expanded coverage and lists of commodities typical of present marketing transactions. Attention is now being given to the improvement of the price series for machine tools and machine-tool accessories, and for waste and scrap materials, such as scrap iron and steel and nonferrous metals, and waste paper and wool.

The Bureau is meeting a request of the National Defense Commission by speeding up its quarterly indexes of living costs in 34 large cities and is inaugurating a national *monthly* index based upon monthly pricing for an abbreviated list of items in 20 of these large cities. Milwaukee has recently been added to the list of these large cities and pricing in Norfolk has been expanded to include Newport News and Portsmouth, Virginia. Extension of the cost of living index to other cities in which the Defense Commission has a particular interest is also planned.

Both the quarterly and monthly cost of living figures will now be available one month after the date to which the prices apply, and certain cities will be available even earlier.

Reports on retail food prices will also be available much more promptly within two to three weeks after the mid-month pricing date. These reports are now being supplemented by weekly price collection for a short list of foods in New York City and St. Louis.

In connection with the needs of the National Defense Commission rents will also be surveyed for a larger number of cities. The Bureau now has available upon request a series of special indexes of rents by rent ranges (e.g., under $15, $15–20, etc.), from March 1935 to date, for the 32 cities in which rents have been collected quarterly during that period.

Beginning this fall, the Bureau inaugurated monthly collection of retail coal prices during the burning season, from October through April, in the 51 cities where prices have been collected quarterly. The quarterly collection in June and September will be continued.

A report on retail prices of hosiery, by areas, from December 1926 through March 1940, and a list of all items on which retail prices are collected are available upon request.

Employment and Occupational Outlook. A new division has been set up to make studies of occupational outlook, in professional and white-collar fields as well as in jobs filled by wage-earners. The Bureau will cooperate with other agencies interested in the general subject of employment opportunities, and for the present will utilize data already available, making its task one of coordinating and analyzing. The studies to be undertaken will provide information concerning (1) the number of workers having certain occupational skills as compared with the number of jobs requiring those skills, (2) the trend of new work opportunities in particular occupations as compared with the number of persons who are being trained for those occupations, (3) the type of training and experience needed for the different occupations and how such training and experience can be obtained, (4) the methods used by workers in obtaining jobs and by employers in hiring workers in the various occupational lines, and (5) the working conditions, hours, wages, and earnings in various occupations.

As part of the monthly reports on employment and pay rolls, information is being tabulated on 70 additional manufacturing industries, most of which have become of increased significance as a result of the defense program. They are industries formerly grouped in a miscellaneous category or represent subdivisions of some of the 90 industries formerly tabulated.

The Bureau has made estimates for the National Defense Commission of the amount of labor which will be created, both on and off the site, by expenditures under defense appropriations. The total figures are classified by the number of workers of varying degrees of skill, and in some instances by occupations. As contracts are awarded, the Bureau estimates the amount of labor to be needed, by months, during the life of the contract; estimates for contracts newly signed are superimposed upon those for contracts on which work is as yet incomplete.

Each week the Bureau makes available a list of all Federal contracts awarded, showing the type of project, location of the work, and dollar volume. A list is issued monthly of the dollar volume of defense contracts in each state and economic area.

The monthly reports on labor turnover now show separately the rate for separations due to entrance into the military service.

Working Conditions and Industrial Relations. In addition to the regular annual surveys of industrial injuries for industry generally and for iron and steel, a study is to be made covering injuries and their causes in 1940 in furniture and other woodworking industries. It will be similar in setup to two special studies of the 1939 injury experience of the lumber and construction industries, published in the September and October issues of the *Monthly Labor Review.*

Representatives of the Bureau of Labor Statistics, the Employees' Compensation Commission, and the Maritime Commission form the statistical subcommittee of a larger inter-agency committee which has been requested

to report its recommendations on a bill introduced into the Congress which would provide for Federally administered workmen's compensation for seamen similar to the system now in effect for longshoremen. A study is being made of injuries to seamen in 1938, comparing the benefits and cost of care provided under present regulations with those which would have been provided under the new bill.

Surveys of wages, hours and working conditions have recently been undertaken in the following industries: lumber, jewelry, embroidery, enameled steel cooking and hospital utensils, seamless hosiery, rubber goods, cotton garments, and cotton goods.

Articles to be published in forthcoming issues of the *Monthly Labor Review* will present a summary of the provisions of State unemployment compensation laws, reviews of State and Federal labor legislation in 1940, and a review of all Federal labor legislation.

Women's Bureau, U. S. Department of Labor

Defense activities have absorbed much of the attention of the Women's Bureau during the past few months. Women workers constitute a practically unlimited reserve of labor, some of it needed at once, and much of it certain to be called upon if the men of the country are summoned to active duty. The Bureau, in order to aid in the effective employment of these women, has appointed a Labor Advisory Committee on Standards for the Employment of Women in the Defense Program. This group represents the international unions that have active women members in industries directly connected with that program. In consultation with this Committee, the Bureau compiled and published information on the effective industrial use of women in the defense program and the value to industry from the maintenance of good labor conditions both from the standpoint of increased production and the health of the workers.

Just issued is a report on industries in the Hawaiian Islands in which women are most largely employed. The survey was made in the late spring and summer of 1939. Eighty-six hundred women at work in pineapple canneries, garment and miscellaneous manufacturing, stores, laundries, barber and beauty shops, hotels and restaurants, and certain white-collar workers were included in the study. Data for men as well as women are reported for all but the group last named. The inquiries made concerned the racial origins of the workers, pay-roll records for a week in 1939, weeks worked and the total amount received by each person employed by the firms that had records for 1938. In addition to the plants of various sorts scheduled by the investigators, a number of employment and social agencies were questioned as to conditions in household employment.

Bureau of Research and Statistics, Social Security Board

Statistics on the causes of blindness. Plans have been completed for the collection of statistics on the causes of blindness of recipients of aid to the blind in States with plans approved by the Social Security Board to be undertaken

in the near future. It is expected that this study will not only provide valuable information on the causes of blindness and means of preventing blindness but will stimulate eye examinations of better quality and assist in the development of plans for more effective treatment and rehabilitation of recipients of blind assistance.

The plans for the study of the causes of blindness were developed in collaboration with the members of the Committee on Statistics of the Blind, sponsored jointly by the American Foundation for the Blind and the National Society for the Prevention of Blindness. Data will be collected only from States which are interested in participating in the project on a voluntary basis and which have eye examination records sufficiently complete and of good enough quality to make the statistics of value.

The study is built about a classification of the causes of blindness which has been developed by the Committee on Statistics of the Blind. This classication has recently been revised by the Committee and describes both the etiological factor causing blindness and the site and type of affection. Information will also be collected on residence, age, sex, age at onset of blindness, extent of vision, and recommendations for medical treatment to improve or conserve vision. Data will be taken from the physician's record of eye examination and the coding of the cases will be made by the consulting ophthalmologist.

Public assistance statistics. A preliminary draft of a handbook on time study methods and analysis for the use of State public assistance agencies has been completed and the manual will be issued in final form within the next few months. The handbook describes the methods of conducting time studies, analyzing and applying their results in budgeting and controlling administrative costs, planning and executing work programs, distributing staff, and performing other executive functions.

Plans are being developed for a study to determine the standards of living of recipients of the special types of public assistance. Data on average monthly assistance payments and the dollar distributions of the monthly amounts approved for recipients of assistance afford only an extremely limited insight into this problem, and no information is currently available on the amount of income received by recipients from other sources or the extent to which assistance payments fall short of meeting their needs. Preliminary work on this project as related to old-age assistance indicates that information will be needed on two groups of factors. The first group, which will assist in determining existing standards, comprises those factors associated directly with the recipient, such as living arrangements, variation in the physical condition and the medical needs of recipients, the resources of recipients other than the assistance payment, and the cost of living. The second group of factors, which will assist in interpreting variations in standards, comprises those associated with the agency administering assistance and the community of which the recipient is a part.

Revision in monthly reporting procedure. Effective with the month of September, 1940, the Social Security Board revised reporting procedures for

monthly reports submitted by State agencies on the number of recipients of old-age assistance, aid to dependent children, aid to the blind, and general relief, to exclude cases receiving medical care, hospitalization, and/or burial only. The collection of data on obligations incurred for these services will be continued, however, and will be published at six-month intervals or less frequently, but no attempt will be made to relate these amounts to cases receiving these services. Reporting procedures were revised in January, 1940, to include cases receiving hospitalization and burial but because of the incomparability in reports which resulted, the Joint Committee on Relief Statistics of the American Statistical Association and the American Public Welfare Association, which serves as an advisory committee to the Division of Public Assistance Research, recommended that a further revision be made. In many States, medical care, hospitalization, and burial are administered by county commissioners or township officers who administer general relief as well as many other governmental services, all of which are provided from general funds not earmarked for specific programs. Accordingly, it is difficult to tell whether the medical care, hospitalization, and burial provided in these areas are or are not a part of the general relief program. In certain States, also, expenditures reported for these services may include a large part of the cost of operating public hospitals and publicly financed medical care programs, while in other States where hospital and medical care programs are not administered by the same officials who administer general relief, only a small fraction of public medical care and hospitalization is included in the reports. The conclusion was reached, therefore, that the most comparable results would be attained by revising the monthly series.

Statistics on family composition. The study of Family Composition in the United States has been extended for another fiscal year. With data from this study as the basis, two studies are in process, one a study of the economic status of the aged—with respect to the age and dependency composition of the wage earners in relation to the occupation and employment status of the aged person and the income and home ownership status of the households of which aged persons are members—and the other a study of the age, sex, marital status, and occupation and employment status of gainful workers.

Research and Statistics Division, Bureau of Employment Security, Social Security Board

Considerable attention has been given to establishment of the newly developed reports which have been designed to furnish information on the availability of labor in occupations essential to the defense program and on general labor market conditions. Forms and instructions have been issued to all State employment security agencies, and the first of the reports have been processed. Summaries were prepared for public release.

Information relating to defense industries. Reports on workers registered in a selected list of 270 occupations essential in defense industries were prepared, and on the basis of those returns, revisions in the form were made, effective with the occupational count to be made as of September 30. Instead

of gross figures indicative of the number of registrants who are primarily or secondarily qualified to work in the selected occupations, additional information is being received to indicate how many of the registrants are immediately available for work and those who are referrable only after additional training has been given the registrants in that occupational skill. The latter is designed to furnish some clues as to the number of registrants who would require additional training before being qualified to work at the specified occupation. Another important change in connection with the report was the expansion of the list of selected occupations from 270 to more than 500. It is expected that additional occupations will be added to the list as their importance in the defense program becomes more pronounced.

Close cooperative arrangements have been worked out between the United States Employment Service Division and the Civil Service Division for the recruitment of skilled labor required at government shipyards and arsenals. In order to measure the effectiveness of the part played by the public employment offices in this arrangement, reports are being received weekly indicating the number of job openings referred by the government establishments to the public employment offices, and the number of applicants referred by the public employment offices to the government establishments. These data are in each case classified according to the occupation involved. On the basis of these reports, summaries have been prepared for use by the operating personnel of the Defense Commission, the Civil Service Commission, and the United States Employment Service Division. Another recently inaugurated report is concerned with the activities of the public employment offices in connection with the defense vocational education training program. Detailed reports are received on the number of job applicants referred by the public employment offices to the vocational education courses and the number of those trained who have been placed in jobs. The referral and placements are classified by activity groups, such as aircraft, automotive mechanics, shipbuilding, etc., according to whether the job utilized or did not utilize the training given in the courses taken. The first of these reports covered only the activities of the public employment offices in relation to this program, but an arrangement has been worked out with other Federal agencies cooperating in the program so that complete summaries of the placement of enrollees in courses and those trained who have been placed in jobs will be made available regularly from these reports.

Another outstanding addition to the reporting program is the projection of probable labor requirements for defense activities on the basis of reports from the State employment security agencies obtained by personal visits to employers. This report represents a refinement of the employer-visiting program utilized by most State employment services. Public employment offices will furnish information on the labor needs of the firms visited for the 60-day period following the visit of the interviewer. Information will be obtained on an occupational basis from a selected list of firms engaged in the production of defense materials and products. For each occupation listed, there will be an indication of the number of workers involved, the expected duration

of hire or lay off, and the age limitations specified by the employer. These reports should provide basic material on the relation of industrial labor requirements and industrial labor supply for the selected group of industries.

In view of the widespread interest manifested in the tabulations of the occupational and industrial characteristics of placements made by the public employment offices, arrangements have been made to provide this information at monthly intervals, instead of on a quarterly basis as heretofore. Special emphasis is being given to information regarding placements in occupations considered essential to the defense program.

Information relating to labor market conditions. In order to obtain an overall picture of developments in employment conditions throughout the country a narrative monthly report on labor market conditions has been inaugurated. The first of these reports on general labor market conditions in the respective States related to the month of September. These reports furnish a considerable amount of information on current developments in local labor markets which has hitherto not been available, and which cannot be covered adequately by quantitative reports. It is believed that this material will provide much information useful to the various agencies concerned with the defense program. The major topics covered by the reports are: changes in demand for and supply of labor, labor stringencies, provisions for adequate labor supply, changes in hiring practices, and labor relations.

Further progress has been made in the editing of the annual reports containing the monthly series on employment and pay-roll data on a major (2-digit) industry group basis. It is expected that this information will be released by the end of the year. Although 1939 material has not yet been released, tabulations have been completed on employment and wages under State unemployment compensation systems for the first 3 months of 1940 and data for the months of the second quarter are expected to be available shortly. These estimates were made on the basis of identical firm samples. The samples invariably comprise more than 70 per cent of the employment for the respective major industry groups in each State. In addition, a weekly series of claimants for benefits in each State has been inaugurated. These data will appear regularly in the *Social Security Bulletin*.

Developments among the states. The Nebraska Employment Security Agency is cooperating with the Bureau of Employment Security on a study of the factors responsible for employers' reduced contribution rates under the experience-rating provisions of the Nebraska Unemployment Compensation law. Data currently submitted to the agency and detailed statements covering employment fluctuations and turnover figures as reported by a sample of employers will form the basis of the report. A similar study by Charles A. Myers entitled *Employment Stabilization and the Wisconsin Act* will be published as Employment Security Memorandum No. 10.

The South Carolina Employment Security Agency has prepared a report on the hourly, weekly, quarterly, and annual earnings of all covered workers for the period July 1937 through March 1939. On the basis of a sample of claimants whose wage records were accumulated over this period, a coopera-

tive study of the effect of alternative benefit formulas upon unemployment compensation benefit rights is being undertaken. A similar study on the basis of somewhat less detailed employment and earnings information is in progress in Ohio. The Iowa agency is conducting a comparison of full-time weekly wage of claimants as reported by employers with weekly wages for the same group as determined by dividing their highest quarterly earnings by 10 and 13.

Twenty-one States have submitted tables indicating the number of weeks of benefit to which workers were entitled and the number of weeks of benefit actually drawn during a year. This series of figures will provide the first information on the duration of compensable unemployment which has become available through the operation of the unemployment compensation program. The duration experience of Michigan claimants were analyzed in the September *Social Security Bulletin* and the experience of claimants in other States will be summarized at a later date.

Analysis Division, Bureau of Old-Age and Survivors Insurance, Social Security Board

As mentioned in the June issue of this JOURNAL, a change in the mechanical operations set up for posting wages in Baltimore necessitates the tabulation of 1939 employee data being made on a sample basis. This sample will consist of approximately 20 per cent of all account numbers. In selecting the sample, an effort was made to obtain as representative a group of account numbers as possible. Separate tabulations will be produced of those account numbers for which wages were reported in 1939 and of those to which no wages were posted for that year. Cross classifications by State of employment, age, sex, race, industry group, intervals of 1939 taxable wages, and also intervals of cumulative wages will be made. Preliminary sorts for this tabulation are now in process. Special studies are also planned for testing the representativeness of the group. It is planned to have this tabulation available for distribution by February 1941.

Contacts are being made with 300 selected large multi-industry concerns to determine the feasibility of making their quarterly reports of individual wage items.

Several tabulations of specific industrial groups have been planned. These groups will include anthracite mining, bituminous coal mining, tobacco manufacturing, and rubber products. A detailed economic analysis will be made of the resulting data to determine the effect of the Social Security Act upon each of these groups. In addition, regular economic analyses will be made of both the 1938 and 1939 data.

Division of Research, Work Projects Administration

Operation and maintenance costs. A number of case studies are being undertaken for the purpose of bringing together factual information and opinions of responsible local public officials concerning the effect of the WPA program

on the future operation and maintenance costs of project sponsors. Field investigations are being conducted to obtain the data for this analysis.

Construction expenditures and employment. A study is being conducted which will break down the estimates of total construction expenditures and employment, by States, for the years 1925 to 1940, inclusive. The report, which will be available in the summer of 1941, will present similar information for each State as that shown nationally in *Construction Expenditures and Employment, 1936–1939.*

Division of Statistics, Work Projects Administration

The *Report on Progress of the WPA Program* for the year ending June 30, 1940, is now being printed and will be available shortly. The report contains special sections on WPA defense activities, airport and airway work, and a summary statement of WPA operating policies and procedures. Other sections cover analyses of WPA employment and expenditures, physical units of work completed, legislative provisions for the current fiscal year, and the place of the WPA program among the public work and assistance programs in the United States.

In addition to the regular reports on WPA workers enrolled in National Defense Vocational Training Project classes, consolidated reports will be developed by the WPA, the Office of Education, and the Bureau of Employment Security on the industries and occupations in which trainees of this project are known to have obtained jobs.

Weekly and monthly employment reports and monthly expenditure reports covering other WPA national defense projects are obtained currently. Accomplishment data for constructions on airport projects, projects operated for the War Department, Navy Department, National Guard, and Coast Guard, and other activities related to national defense have been summarized as of the end of June 1940, and a second report will be obtained as of the end of September.

Other special WPA reports include a summary of work completed on all construction projects operated by WPA, covering the five-year period from the beginning of the program through June 30, 1940. Similar summaries of accomplishment in individual states are nearing completion and will be issued early in October.

Average General Relief Benefits, 1933–1938, prepared jointly by the Division of Statistics and the Division of Research, has been released for distribution. The report gives particular attention to the period from May 1933 through December 1935 when the Federal Emergency Relief Administration was granting Federal funds to the states for general relief purposes. More complete information is available concerning general relief programs during this period than for subsequent months when state and local governments were responsible for the administration and financing of general relief. The report discusses general relief policies and procedures, variations in average monthly relief benefits, and the social, economic, administrative, and technical factors that influence these averages. Copies of the report may be obtained upon request.

Food and Drug Administration, Federal Security Agency

The use of statistics is becoming more general in the Food and Drug Administration in connection with setting of the new standards for foods, and with the enforcing of these standards. The new Food, Drug, and Cosmetic Act in all of its provisions became fully effective on July 1, 1940. This coincided with the transfer of the Food and Drug Administration from the Department of Agriculture to the Federal Security Agency. The new law, among other things, gives the Administration power to set standards of identity and minimum quality for food products.

The making and enforcing of these standards, together with other regulatory activities, necessitates the gathering of large amounts of data of various kinds, ranging from the weight and chemical constituents of fruit in a can packed under known conditions, to the spectrophotometric measurements of color in dye mixtures used in food, drugs, and cosmetics, and the reaction of frogs to various dosages of digitalis. Many problems arise in which statistics may be used to give a short-cut solution, and the large volumes of data have made it desirable to install Hollerith machines. A punch verifier, tabulator, sorter, and summary punch were installed last August and already have proven their value in the speed with which results can be obtained. When large amounts of data are gathered they are immediately punched on cards and are then ready for analysis at any time. Frequently during standards hearings or Court cases existing data must be analyzed quickly. Time is the important factor, and if the data are on punched cards, the desired facts can be obtained readily on the Hollerith machines.

Methods are being developed for using the Hollerith machines for research also. The method used to fit regression lines is well known, and of course analysis of variance can be done very speedily by the use of progressive digiting of punched cards. A method has been developed of fitting orthogonal polynomials to weekly observations on the growth of rats by using punched cards. The calculation of tristimulus color values from photoelectric colorimetry curves (which was formerly a very lengthy process) has been adapted to punched cards.

Design of experiments and use of sampling procedures form another phase of the work. Also, an investigation is being conducted as to the type and magnitude of errors of chemical determinations—how closely a chemist can duplicate his own analysis, how closely he can duplicate an analysis made by another chemist with the same laboratory equipment, and how closely he can duplicate an analysis made by another chemist at another laboratory.

An interesting use of statistics came up recently in the interpretation of the results of tasting panels. The experiment was conducted to give an indication of whether or not the general run of persons could detect differing amounts of sweetening agents in series where the agent was alone, and in others where it was competing with other flavors. These panels consisted of several people who blindly tasted the members of each series and ranked them according to sweetness. An application of analysis of variance to the ranked data afforded a numerical measure of the changes that the results

secured could have been obtained with series the members of which were identical in composition and sweetness.

Bituminous Coal Division, Department of the Interior

The economic and statistical work of the Division was brought together in the organization of an Economics Branch effective May 10, 1940. The purpose of this Branch is to formulate and carry out the statistical and research programs of the Division.

On March 11, 1940, the U. S. Department of the Interior and the U. S. Department of Commerce effected a cooperative agreement under which the Bituminous Coal Division of Interior and the Census Bureau of Commerce have made use of joint questionnaires (Forms T-1, covering rail mines producing over 50 tons daily; T-2-C, covering truck mines of less than 50 tons daily; and T-CO, covering central offices) for the collection of data of bituminous coal production and mine operation in the year 1939. By this means the two agencies have canvassed the operators for the data necessary for their purposes and have avoided burdening the industry with overlapping questionnaires.

Dun & Bradstreet, Inc.

Inquiry into the Economic Consequences of Rearmament. This series is being continued. In the October issue of *Dun's Review* an appraisal was attempted of the unpleasant economic and social results of defense spending during the last war, and of the means at the disposal of our contemporary Defense Commission and purchasing authorities to minimize them in the present crisis. The evolution of negotiated contracts as a partial replacement for competitive bidding was traced, together with a summary of the efforts being made to convert the new purchasing plan into a stabilizing instrument. Similarly, the strong and weak points of compulsory and voluntary priority were examined.

A new article will cover the efforts of a government with still limited powers to check or forestall runaway prices in vulnerable commodities. This study looks into the somewhat mercurial attitudes taken by Congress during the past few years toward profit limitation, and thence into the principles appearing to emerge from the struggle of the new Consumer and Price Stabilization Divisions with their uncharted tasks. A final section will deal with the peculiarities of the role played by prices and profits in an emergency of the present character, and with the pitfalls that current events have already shown to lie in the way of hasty judgments concerning them.

The study is expected to move on into the problem of financing necessary new capacity in ways that will both insure an adequate flow of investment and protect the public from bursts of excessive generosity. In this sense, industry is lumped with the "public," on the assumption that sooner or later competition will have to pick up where it was interrupted by the intrusion of unprecedented orders from an unstinting government for unconventional merchandise.

Survey of Retailers' Operating Costs. With the completion and issuance of the individual surveys for about 50 trades a series of special studies has been initiated, cross-sectioning the results of the Survey in various ways.

The first of these contrasts the operating characteristics of high and low margin trades, inventory turnover, expenses, rates of profit on sales, and apparent relative rate of return on investment. The second study similarly explores the characteristic differences in margin, expense and other operating ratios of cash and credit stores in the same trade and of open credit versus installment stores in the durable goods trades. The third study explores retailers' advertising costs in various sizes of towns by kind of trade, size of store and profit status. The fourth is a study of rental costs and tenancy in retail trade, exploring, in addition to the rent ratios, the proportion of tenants and owners in various trades and in similar details of the advertising cost studies previously described. A fifth study is proposed to deal with typical sizes of store units in various trades, wage costs in retailing and the dollar return to the proprietors of typical stores in these various categories. These studies are being published serially in *Dun's Review* beginning with the October 1940 issue.

Study of Accountancy Problems as Related to Balance Sheets. Last May, Roy A. Foulke, Manager of the Specialized Report Department, prepared a questionnaire containing sixteen points regarding accountancy and accounting problems. Fifteen hundred of these questionnaires were mailed to each of four groups of carefully selected individuals located in all parts of the country who had evidenced their serious interests in the trends of evolution in accountancy; namely, lending officials in banks, financial executives of large industrial and commercial corporations, mercantile credit men, and accountants.

Replies were received from 22.7 per cent to 30.2 per cent of those canvassed in these four groups. The replies to the questionnaire are being summarized at the present time and the completed survey will probably be available for distribution some time in December.

Studies of the Seasonal Characteristics of Industry. This monthly series of bulletins was discontinued in the spring of 1940 because of the pressure of other studies, but it is being resumed starting with December 1940. Each bulletin explores the seasonal fluctuations of sales, inventories, receivables, and current liabilities of one industry or trade and suggests logical fiscal closing dates. The series was instituted at the request of the Natural Business Year Council and is being carried forward under the sponsorship of the national and of various state associations of accountants.

A list of the 23 bulletins already published and copies of bulletins on specific industries in that list may be obtained on request from the American Institute of Certified Public Accountants or from Dun & Bradstreet, Inc. Scheduled for early release are bulletins on fertilizer manufacturing, cane sugar refining, and beet sugar manufacturing.

National Bureau of Economic Research, Inc.

Five Carnegie Associates have been appointed to participate in various projects at the National Bureau during 1940–41: W. Braddock Hickman, of Princeton University, for the bond project of the Financial Research Program; Roy W. Jastram, of Stanford University, to aid the Committee on Business Price Policies of the Conference on Price Research; Edward E. Lewis, of Howard University, for the business cycles unit; Horst Mendershausen, of Colorado College, to study the distribution of national income by size; and Lorie Tarshis, of Tufts College, for the labor unit.

To expedite the preparation of the monograph on the Cyclical Behavior of Transportation, Thor Hultgren, formerly of the Bureau of Statistics of the Interstate Commerce Commission, has joined the business cycles unit.

The Financial Research Program has published its seventh volume in the consumer instalment financing series. It is now concentrating attention on the bond project and the study of Trends in the Financial Structure of American Business. As announced in National Bureau *Bulletin 80*, The Credit Analysis Unit of the Division of Marketing Research in the Bureau of Foreign and Domestic Commerce is continuing the estimates of consumer instalment credit, recently published for 1929–38 by the National Bureau. Duncan McC. Holthausen, who prepared the report in collaboration with Malcolm L. Merriam, Chief of the Credit Analysis Unit, and Rolf Nugent, of the Russell Sage Foundation, has gone to Washington to participate in this project.

The National Bureau announces also in *Bulletin 80* that it and the Conference on Price Research are cooperating in an advisory capacity in a comprehensive study of wholesale prices being conducted by a WPA unit under the sponsorship and supervision of the United States Bureau of Labor Statistics. The most important objectives of the study are: (1) to provide authenticated, continuous series of wholesale prices by months back to 1890; (2) to tabulate information concerning the terms and conditions of sale in the distribution of commodities for which price quotations are compiled; (3) to correct individual price series for seasonal variations; (4) to construct monthly index numbers for economically significant classes of commodities; and (5) to prepare a comprehensive bibliography of price index numbers in the United States. The advisory committee set up by the Conference on Price Research includes H. B. Arthur, Swift and Company; M. A. Copeland, National Defense Advisory Commission; R. H. Whitman, R. H. Macy and Co.; and F. C. Mills, National Bureau of Economic Research.

Progress Report on the Twentieth Century Fund

The special industry chapters of the Fund's study of collective bargaining, of which Dr. Harry A. Millis is Research Director, have been virtually completed, with one or two exceptions. These industry chapters are undergoing final editing and it is expected that the volume (including reports on collective bargaining in fourteen industries) will be ready to go to the printer

early in 1941. The published report should appear by February or March.

The appearance of the defense emergency led the Fund to authorize a special study of labor problems in relation to the defense program. Dr. Lloyd G. Reynolds, of the economic faculty of the Johns Hopkins University, was engaged to direct this inquiry. The field work was completed early in September and the report will be published in January.

Dr. Frederick R. Macaulay is continuing his investigation of the economic effects of short selling on the New York Stock Exchange, and according to the present schedule he will have completed his work by November 15th. A large part of the statistical analysis has already been completed and a substantial part of the text is in final form. In view of the difficulties of reproduction of statistical and graphic material, it is doubtful whether the report will be ready to go to the printer in the spring of 1941.

The Fund's study of the relation between the electric light and power industry and the government is being pushed rapidly to completion, closely in accord with the original time schedule. All of the field work has been completed and a large part of the text is in final form. This study should be ready to go to the printer by March, 1941.

Shortly after Mr. Miles L. Colean had taken up his duties on the Fund's study of housing in relation to employment in the United States the defense emergency led the Housing Committee and the Trustees to authorize a hurried investigation of the problems of housing in relation to the defense program. This investigation was completed and the printed report was released in November, 1940.

Developments in Statistical and Research Work, American Standards Association

Recent developments in statistical and research work of the American Standards Association include formal approval of an American Standard for Rounding Off Numerical Values. This sets forth a simple and effective method for rounding off, pointing out a common error followed by most of our schools. In addition to the work of a very competent technical committee, the standard has been gone over by a number of professional societies in the field of mathematics, physics, chemistry, education, statistics, etc. Copies of the standard are available from the American Standards Association at 29 West 39 Street, New York.

The American Standards Association's committee on Graphic Presentation (Z15) has during the year completed work on a standard for engineering and scientific graphs for publication. Copies of this standard are now being circulated for general criticism and comments. Committee B46, working on Surface Qualities, has developed a draft standard, of which over 6,500 copies have now been circulated for trial and criticism.

The committee working on an American Standard for Compiling Accident Statistics has during the past year prepared a revision of the proposed code as a result of further research and statistical work.

As a result of the research work carried on by the United States Bureau of Home Economics, which included measurement of some 147,000 children throughout the United States, an American Standards Association committee has developed a series of average body measurements for boys in the age range from kindergarten to high school. This is a definite step toward the approval of an American Standard for body dimensions which must be developed before we can get a standard for the fit of garments.

National Industrial Conference Board

Management Research Division. The research activity of this Division concerns the problems of business operation, largely those concerned with the employer-employee relationship. In recent months it has continued its program of study of subjects of constant interest in the field of company administration but has given special attention to matters directly concerned with the program of national defense. Thus, while adhering to a long-time policy of reporting to its associates about leading problems in everyday company operation, it keeps its program flexible so that it may make quick studies of subjects which assume particular significance because of the needs of the national defense emergency. Among its recent reports are the following: Personnel Practices in Factory and Office; Employment of Aliens and Plant Protection; Job Evaluation—Formal Plans for Determining Basic Pay Differentials; Quick-Training Procedures; and Company Policies Regarding Military Absences.

The Management Research Division works in close collaboration with an Advisory Council composed of prominent operating executives and personnel directors who assist the Division's staff in keeping the research program closely geared to the vital needs of American business.

Division of Industrial Economics. In recent months the staff of this Division has been engaged in a series of investigations of basic problems affecting national defense. These studies have been released as separate entities embraced under the general title of "Studies in the Economics of National Defense," as supplements of *The Conference Board Economic Record*, under the following titles: Raw Materials for National Defense; Skilled Labor: A Vital Link in Defense; Germany's Economic Mobilization for War; The French War Economy; Consumption, Savings, and Defense Financing; Fiscal Possibilities for National Defense; and Manufacturing Resources for Defense.

Additional studies under way will treat with problems of labor, agriculture, banking, investment, prices, foreign trade, and international relations.

CHAPTER ACTIVITIES

The Cleveland Chapter

The first meeting for the season of the Business Statistics Section was held September 30. C. A. Cowdrey, of the Warner and Swasey Company, was selected as Chairman for the coming year and William P. Carlin, of the Republic Steel Corporation, was chosen Secretary.

The meeting was devoted to a forecast of the Federal Reserve Board's index of industrial production for the last quarter of 1940 and the first quarter of 1941. Nine members presented forecasts and each one attempted to justify his predictions. The composite was fairly optimistic. For March of 1941, the group estimated that the index would reach 130. The individual forecasts ranged from 123 to 138.

The New York District Chapter

The small dinner and discussion groups which were inaugurated by the New York District Chapter last year will be resumed. The groups now being organized, and the Chairmen or Committees in charge, are as follows:

Industrial Statistics—Robert W. Burgess
Statistical Techniques—Helen M. Walker
Consumer Finance—Rolf Nugent
Public Utilities—Charles Tatham, Jr.
Business Cycles—Charles F. Roos
Public Health—Mary Augusta Clark, Hugo Muench, Thomas J. Duffield, Charles B. Lawrence, and Jessamine S. Whitney
Security and Capital Markets—Bradford Bixby Smith, J. F. Hughes, Warren Clark, Lawrence Gilary, Benjamin Graham, Harold Gartley, A. W. Kimber, J. H. Lewis, Glenn G. Munn, and Bradford Story
Membership Committee—J. Frederic Dewhurst, Frederick Hurd, and H. William Loss

The Austin, Texas, Chapter

The Austin Chapter held its first meeting of the season on October 23. Officers present were C. W. Vickery, president, and Leo C. Haynes, secretary. Speaker at the luncheon was W. F. Callander, in charge of the Agricultural Statistics Division, Agricultural Marketing Service, U. S. Department of Agriculture, who described the organization of statistical work of his division. Qualifications for the profession of statistician in general and for agricultural statistician in particular were discussed. The difficulty of finding mathematical competence in combination with practical proficiency was pointed out. A report was given by Mr. Vickery on the work of the Committee on Chapters and the promise it holds of speakers for the Austin Chapter.

CHANGE IN ASSOCIATION'S PUBLICATION PROGRAM

In accordance with the action of the Board of Directors at its meeting in September, 1940, a number of changes in the Association's publication program will take effect at the beginning of 1941. The Statistical News and Notes and the Chapter Activities, which have been regular features of this JOURNAL in recent years, will henceforth appear in the *American Statistical Association Bulletin*. The JOURNAL will be devoted to scholarly articles and major notes, and to book reviews.

The *Bulletin* will be published six times a year instead of four times. It will serve to bring to members current information on developments in the principal public and private statistical agencies and the Association's chapters, and news about members. It will provide a forum for the discussion of current problems and the exchange of views on statistical questions.

R. L. FUNKHOUSER, *Secretary*

A CORRECTION

The Statistical and Social Inquiry Society of Ireland was inadvertently omitted from the list* of the societies and other organizations which were represented or sent messages of felicitation at the time of our Centenary Celebration.

The Federal Income Tax, A Reply to the Review

One hesitates to call attention to the incorrect and misleading statements in a review of his book, yet, when they are excessive, not to do so may result in misleading some who are not acquainted with the book or the reviewer. It is not surprising that Mr. George O. May, an accountant, thinks that our volume, *The Federal Income Tax*, should give more attention to accounting problems and less to others (see this JOURNAL, Sept., 1940, pp. 578–79), nor are we surprised that an apparently hasty sketching of the book did not "add greatly to [his] existing knowledge of the subject."

In fact, the reviewer's examination of the book appears to have been so sketchy that he overlooked its main purpose. It was not our purpose to add another to the already numerous income tax accounting manuals or to write a book for any other special group of income tax practitioners. Rather, it was our aim to present the income tax in the setting of our political and economic regimes so that everybody—accountants, lawyers, legislators, economists, political scientists, and intelligent students from all fields—could view it, not exclusively through the narrow and colored glasses of their several special interests, but as an entity and in proper perspective, and especially as a living part of our evolving politico-economic organization. Happily, most reviewers whom we have read and even income tax specialists writing us personal letters have not missed the main point.

* This JOURNAL, Vol. 35, No. 209, Part 2 (March, 1940), pp. 214–215.

There are numerous other indications that this review was prepared on the basis of a hasty examination. For example, Mr. May says: "Particularly striking is the failure to indicate the part played by regulation in the development of the law."

This is exactly the opposite of the truth as careful reading would reveal or as Mr. May or anyone else can easily prove by reference to the index. The authors recognized and stressed the importance of rulings and regulations throughout the book and called attention to the influence of economists, accountants, lawyers, taxpayers and others. For example, see pages 6, 55, 100, 416, 500, 530, 547, and the chapters on Definition of Income and Administration. Mr. May makes the special point that the "impracticability" of the 1909 law and "the confusion over the terms 'paid' and 'accrued' " . . . "are passed over without notice."

Compare this with the following excerpt from the book (footnote p. 500).

> An interesting attempt of accountants to change the wording of the law was made in 1909. At that time the excise tax bill provided for taxing income actually received and expenses actually paid, and made no provision for accrual accounting. Although the accountants protested that this was an unworkable basis, their protests were not heeded. The difficulties they cited had to be taken care of later by the Regulations. See Chap. II above.

Mr. May and others are referred to the text and the index for numerous other illustrations for which space is insufficient here. We are sorry that lack of space also prevents our taking up all the points of the review. We should, however, mention some of our sins of commission as well as those of omission.

We regret very much that one of our sentences gives a misleading impression of English practice with reference to depreciation and also that our chapter on the definition of income, dealing with the opinions of courts, economists, accountants and others, though having "obvious merits," is "not always accurate." No instance is specified, so discussion would be futile. We may say, however, that though we took extensive precautions to avoid errors, we would be the last to assert that we made none. We are consoled, however, by the fact that neither the Supreme Court nor any commentator dealing with income in extenso has succeeded in defining it or in interpreting the decisions and definitions of others without making errors, in the opinions of others.

After reading all the rest, some unwary reader of Mr. May's review might interpret two statements near the end as implications of gross carelessness, incompetence, or even of intent to deceive. (1) He says our statistical tables are "largely taken from partisan presentations in support of measures proposed." They are, in fact, taken mostly from official (regular and special) reports of the Treasury and Congressional committees, with citations and explanations of backgrounds so that all may evaluate them. (2) The two appendix tables relative to consolidated returns to which he takes special exception, were given because they were the best and practically the only data available except some admittedly unreliable guesses, as indicated in the text. It is difficult to understand just why the reviewer should labor the

point that these data did not [and could not] take proper account of changes in yields that would be caused by changes in corporate procedure if the law was changed, as if our text had not already made that point quite clear.

We hope all interested will read the book and appraise it for themselves.

ROY G. BLAKEY

University of Minnesota

Rejoinder

Professor Blakey's somewhat emotional letter contains nothing tending to negative the conclusions reached by this reviewer after a careful reading of *The Federal Income Tax*. The use of more space in the JOURNAL is, therefore, warranted only for comment on the purely statistical questions raised by him.

To the criticism that the statistical tables were "largely taken from partisan presentations in support of measures proposed," Professor Blakey replies that they were mostly official reports. Experience shows, unfortunately, that there is no necessary inconsistency between the two statements.

To the criticism of the tables on pages 594–95, Professor Blakey replies that they were given because they were "the best and practically the only data available except some admittedly unreliable guesses, as indicated in the text." This raises the question whether detailed statistical tables, however carefully compiled, which rest on a basic assumption obviously contrary to all probability (as the text shows these tables to have been) are worth more than guesses based on realistic assumptions. This reviewer thinks not; but his statement that the statistics in question were of an "undesirable type" could not reasonably carry such "ugly implications" as Professor Blakey fears may be drawn from it.

GEORGE O. MAY

New York City

Capital Expansion, Employment and Economic Stability,

A Reply to the Review

As a general rule we have a strong aversion to replying to the critical comments of a reviewer; it seems appropriate to allow the issues to pass unchallenged, leaving the reader to reach his independent judgment. But there are times when the character of a review is such as to leave the author no respectable alternative. Solomon Fabricant's review of *Capital Expansion, Employment, and Economic Stability* in the September issue of this JOURNAL is a case in point.

Following a sketchy paragraph of summary—in which some of the most important contributions of the volume are not mentioned—the reviewer challenges the statement made in the introduction that "the persistently depressed condition of the so-called capital goods industries appears to be generally regarded as the feature which most strikingly distinguishes the present period from the economic recoveries of former times." He questions both whether this is true and whether it is *generally regarded* as so.

In introducing the reader to the general problem with which the volume is concerned, we did not think it necessary to demonstrate that this country has suffered from a restricted capital expansion during the recent years or to compile evidence in the form of extensive quotations from current literature in order to justify the statement about prevailing beliefs. We took it for granted that every well-informed person knows that government economists as well as leaders in the business and financial community admit the fact of a restricted rate of private capital expansion. While one group finds the cause in the maturing of the economy, the other attributes it largely to adverse government policies.

The book itself does, however, supply supporting evidence with respect to the restricted rate of private capital expansion. Reference need merely be made to Chapters I and II where extensive data are presented with respect to private capital flotations over the whole period from 1907 to 1931. The low rate of private capital expansion in the thirties as compared with the twenties is also shown by data published by the National Bureau of Economic Research on capital formation. Incidentally, Mr. Fabricant's forthcoming investigation of manufacturing production, as publicly reported by Dr. Leo Wolman, reveals that as far back as 1899 the experience of the thirties finds no parallel. But Mr. Fabricant says that in our study "the possibility that a similar situation may have existed in earlier periods such as in the 1890's is not discussed." While we did not think it necessary for the purpose in hand to make a long historical investigation, we do not believe that the facts would show, as Mr. Fabricant implies, that the recovery movement from 1896 to 1901 left the level of production and capital formation lower than it was in say 1890. If Mr. Fabricant has evidence to this effect, we should, of course, be glad to see it. Mr. Fabricant says further "nor is there full recognition of the possibility that the volume of investment during the pre-depression period 1923–29 was unusually high." Even if one grants this "possibility," it would have no bearing on the issue under consideration.

Mr. Fabricant also questions whether there is any lack of confidence among entrepreneurs and investors and deplores the fact that we did not submit more concrete evidence and give a more adequate *theoretical* discussion of this problem. He cites the fact that there has been *some* capital expansion and extensive purchases of government securities as evidence of confidence. The purchase of government securities, mainly short-term issues, would seem to us to indicate a lack of confidence and a quest for short-run safety, rather than confidence in long-term private investment.

Equally indefensible are the reviewer's criticisms with respect to the handling of certain statistical material. He states that the *Statistics of Income* data "are used as if they were strictly comparable from *year to year*," and that changes in the number of corporations and in methods of reporting which occurred in 1934 are overlooked. We do not make any year to year use of these data. We use only the aggregate changes for the eight-year period 1930–37. Adjustments to take account of the 1934 changes—which we carefully considered in the light of available overlapping data—would not appreciably alter the picture.

He states that the inclusion of doubtful series like those of the Journal of Commerce on new issues "detracts from the value of the collection." These data were used for the early years when no other series were available; and we were careful to state that they were "less precise and less comprehensive than those for the later years." Their inclusion does not *detract* from the value of the other series; they constitute a useful supplementation.

The reviewer's charge that we *misuse* data by treating "corporate savings as equal to changes in assets thus ignoring the fact that changes in liabilities may and do occur," is based on an entire misconception of the purpose of the table under discussion. We were not pretending to show changes in the amount of corporate *savings*. What we did (page 116) was to show "the annual disposition of corporate gross income" in order to reveal the *immediate* effect that the annual operations of corporations had on assets from 1926 through 1937. *After* the income for a given year has been distributed, a corporation may, of course, decide to devote some of its assets, new or old, to the reduction of liabilities. That decision does not in any way affect the way in which the *income of the corporation was distributed*, but represents a reduction in both the liabilities and assets of the corporation *subsequent* to that distribution of income. We are aware, of course, that there are two sides to a balance sheet and that changes in total assets not only *may* but *must* be accompanied by changes in liabilities.

Similarly the reviewer's contention that we have *misused* data by holding that depreciation and depletion charges measure the dissipation of fixed assets, indicates a misunderstanding of the purpose of the analysis. What we were interested in showing (table on page 117) was the extent to which unprofitable corporations, as a result of their operating losses, had used up current assets and had failed to maintain their fixed asset position out of current earnings. Whether they subsequently used some of the remaining current assets to build up fixed assets, or vice versa, is another question.

The reviewer regrets that we didn't write a glossary defining such terms as "savings," "investment," "capital expansion," and "superabundance of funds." Our use of "savings," "investment," and "capital expansion" is explicit and consistent throughout. Whenever the term "savings" is employed the specific phraseology or the context makes it clear that the term relates solely to *money* savings available for investment. The term "investment" is always employed in the money market sense—involving the purchase of securities or other financial instruments. The term "capital expansion" is used to mean the growth of physical capital—which, as we conclusively show, usually does *not* coincide in volume either with investment or money savings. The term "superabundance of funds" is intended to convey that outlets for long- and short-term investment are wholly inadequate to absorb the funds seeking outlets. One wonders if Mr. Fabricant is not familiar with the phenomenon of idle funds as evidenced by the unusual cash balances both of large corporations and of individuals, with the fact of excess reserves, and with the difficulties being experienced by financial institutions in finding outlets for funds at their disposal. If not, he would do well to read this volume carefully.

The reviewer's statement that "the distinction between gross and net investment especially needs to be made clear," is interesting in view of the fact that we do not make use of either term; we nevertheless strongly emphasize the distinction he has in mind in our discussions of capital *expansion* as distinguished from *replacement* (pages 186–89).

Finally the reviewer observes that the volume is devoted almost entirely to capital expansion, with very little discussion of employment and economic stability. Presumably he thinks the volume should have been divided into three more or less independent parts—capital expansion, employment, and economic stability respectively. We believe the bearing of restricted capital expansion upon employment and economic stability is pointed out with sufficient clearness to warrant the title of the volume.

HAROLD G. MOULTON
GEORGE W. EDWARDS
JAMES D. MAGEE
CLEONA LEWIS

Brookings Institution

Rejoinder

In my review I questioned the adequacy of the evidence and of the reasoning of the authors in support of their chief conclusions; suggested that a careful definition of concepts and terms might have been useful to the reader, if not to the authors; and commented on the utility of the book as a collection of statistical data.

Let me summarize again the chief line of argument followed by the authors: The absence of a large measure of capital expansion is the distinguishing characteristic of the recovery period 1933–39. It is this that explains in large part the low level of economic activity and the unprecedented volume of unemployment during the last few years. The failure of capital investment to expand to 1929 levels cannot be ascribed to the absence of investment money or to the impairment of the financial condition of American business concerns; it must be ascribed to the frictions, inhibitions, and lack of confidence caused by those acts and policies of government connected with security market regulation, taxation and, perhaps most important, the "philosophy of the unbalanced budget" and all it implies. By this reasoning the authors are led to certain recommendations concerning security regulation, taxes, and budgets.

In my comments on this line of argument I asked, first, for the evidence that the depressed condition of the capital-goods industries was indeed the most distinguishing feature of the period 1933–39. It seemed to me that only a comparison of the various and many economic changes during these recent years with the various and many economic changes during other periods following prolonged declines in general business could provide any trustworthy evidence on the questions (1) whether this was a *distinguishing* feature, and (2) whether this was *the most* distinguishing feature. No such comparison had been made by the authors. The mere assertion, whether or not popularly believed, hardly establishes as fact that the distinguishing characteristic of the

last 8 years has been the slow rate of capital expansion. I did not, of course, deny that this was *a* feature of the recent period, or even that it was the most distinguishing feature.

The authors, I noted, had not taken adequate account of the possibility that the volume of investment during 1923–29 may have been unusually high, and that this may have had some effect on the depression that followed. It seemed to me that the hypothesis that the events during 1933–39 were connected in some way with the events of the preceding period of prosperity could not legitimately be ignored. Yet despite the fact that the authors made much of the failure of capital formation to advance to the pre-depression level, they did not discuss the character of this "base." To this criticism the authors have not replied. Indeed, they seem to confuse it with the point made in the preceding paragraph, of which they believe it to be a part, and therefore consider the criticism to be irrelevant.

In my review I wondered about the basis of the authors' statement that the low level of investment "explained" the low level of output and employment. There is no discussion of this important causal relation in the volume; nor are there any references to analyses made by other writers. All that the authors have to offer is the bare statement that "we cannot expect to eliminate unemployment without an expansion of capital enterprise." This assertion is hardly sufficient to justify the title of the volume, let alone the conclusions reached by the authors that the small expansion of capital enterprise in 1933–39 goes far in "explaining" the unemployment in those years. Nor are the authors aware of any incongruity in statements made by them, and also implied in the title, that a substantial rise in the rate of capital expansion will lead to economic *stability*.

On the last and perhaps crucial question, that of "confidence," I pointed out that little concrete evidence had been given, and that the theoretical discussion was inadequate. The relation between the state of "confidence" and capital expansion must indeed be intricate since some capital expansion did in fact take place. There are *degrees* of confidence. Certainly, in an argument which hinges vitally on the relation between confidence and capital expansion, there should be some discussion of variation in the degree of confidence, and of the possibility or impossibility of measuring this degree. An examination of the nature of "confidence" might have led the authors to a deeper realization that beside costs of selling securities and present or future taxes there may be other factors, also important, that conceivably affect estimates of prospective returns to capital. In that case they might not have ascribed to "the factors which directly affect the flow of funds into investment enterprise"—the only factors examined in a study of admittedly limited objective—such unqualifiedly fundamental importance in explaining the low level of economic activity and employment during the last few years.

I noted that a systematic statement of terms and concepts would have been useful. The ambiguity of terms like "savings" and "investment" is attested not only by the many papers that have appeared on conceptual,

terminological and statistical pitfalls in this field but also by the definitions the authors give in their rejoinder. Do "money savings" include realized or unrealized capital gains? Do they include money received through repayment of loans? What does "available" mean in their definition of savings and how can "available" savings be measured? Should "investment" include the purchase of refunding issues and issues of investment trusts? If so, what is the connection between such issues and the "condition of the capital-goods industries?" Does "capital expansion" cover also consumers' and governmental durable goods and producers' inventories? Should it be measured gross or net of depreciation? Should it include expenditures on maintenance? Since aggregate net capital formation equals aggregate net savings (except for statistical errors), just what meaning is to be ascribed to the term "superabundance of funds?" How does one distinguish between the inadequacy of outlets for funds and the desire for liquidity? It is true that the authors touch, here and there, on some of these questions. But only a systematic array of concepts and terms can enable one to see the connection between the various measures presented in the volume, and the degree to which the available statistics conform to the definitions set up.

In considering whether the volume would at least prove to be a useful and trustworthy collection of data, I noted several faults of the collection. Concerning the data on new security issues prior to 1914, the authors state that the "available data are not strictly comparable for the various time periods or as among the several groups themselves. Nevertheless, they are sufficiently comprehensive to give us a reasonably accurate picture of the capital market" (p. 8). This is hardly an adequate characterization of these data. No overlap is provided showing the difference between the Journal of Commerce data used for 1907–19, and the Chronicle figures used for 1920–39, and no indication is given of the importance of refundings, deducted from some series and not from others.

The *Statistics of Income* corporate data were presented and used, I noted, as if they were comparable throughout the period discussed. For example, on p. 114 the authors give a table showing the total assets of corporations by major industrial groups for each of the three years 1926, 1929 and 1937. Data for intervening years are given in an appendix table, p. 367. The authors comment on the change from 1929 to 1937 in the assets of each of the industrial groups, and in the total for all the groups. There is no qualifying statement either here or in the appendix concerning three flaws in these statistics. One, relatively minor, arises from changes in the fraction of corporations reporting balance sheets. Another, rather important, results from changes by the Bureau of Internal Revenue in the definitions of the industrial categories (cf. the shift of an important group of companies from "finance and real estate" to "service," reported in *Statistics of Income for 1932*, p. 22), and from the unscrambling of consolidated reports in 1934. The breakdown of consolidated reports in 1934 led also to a third incomparability in total assets: between 1933 and 1934 investments (and therefore total assets) were inflated by the amount of holdings of securities of subsidiaries,

formerly eliminated in the consolidated reports. Certainly the reader should at least be warned against the possibility of errors arising from these incomparabilities, especially since the errors may be large in relation to the changes in total assets that are discussed by the authors.

The last concern of my review was the misuse of data by the authors. Let me quote (p. 116): "It will be seen that in every year in the late twenties, the income available, before deductions for cash dividends and the various allowances, exceeded the amount of the dividends and the requirements for bad debts, depreciation, and depletion. The result was an increase in either fixed or working capital assets." The last sentence is quite definite—and wrong. For the result was an increase in assets, *or* a decrease in liabilities, *or* a combination of both. It is true that on p. 113 the authors noted in general terms that debts may change in amount; but this does not justify the carelessness of the statement on p. 116. Again, I said that depreciation and depletion charges are considered by the authors to measure the dissipation of fixed assets (table, p. 117). The table referred to is entitled "Asset Dissipations," and includes three columns, headed "current assets," "fixed assets," and "total assets," respectively. The figures in the column headed "current assets" are corporate savings before the deduction of depreciation and depletion charges, while those in the column headed "fixed assets" are simply the depreciation and depletion charged by the companies covered. These headings are clearly misnomers. If the data are not "misused," they are certainly mislabeled.

I must repeat: The main conclusion of the volume—that governmental policies and practices were in large part responsible for the low level of capital expansion during the last 8 years, and that this low level in turn was an important causal factor in the low level of output and the high level of unemployment—is adequately supported neither by the evidence presented nor by the arguments set forth. Moreover, the volume cannot be considered a safe source of data to which to send the general reader.

SOLOMON FABRICANT

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BOOK REVIEWS

GLENN E. MCLAUGHLIN
Review Editor

Family Income in Chicago, 1935–36, by A. D. H. Kaplan, Faith M. Williams, assisted by Erika H. Wulff. Washington, D. C.: Bureau of Labor Statistics, Bulletin No. 642, Volume I. 1939. x, 210 pp. 25 cents.

Family Expenditure in Chicago, 1935–36, by A. D. H. Kaplan, Faith M. Williams, and Mildred Hartsough. *Ibid.*, Volume II. 1939. ix, 256 pp. 30 cents.

This is a somewhat belated review of the first of the Consumers' Purchases Studies upon which so much time and money have been lavished by a galaxy of federal agencies. As is well-known, this was an attempt to get adequate samples not only of the wage-earning and lower-salaried classes, as had been the case with the previous 1901 and 1918–1919 studies, but to include the middle and upper economic classes as well. An elaborate sampling technique was developed and faithfully carried out insofar as was possible. In Chicago alone, no less than 36,223 families or nearly 5 per cent of the total were sampled—an almost unprecedented number. In spite of this great care, there are two almost unavoidable sources of error in the study. (1) There is a tendency, as Miss Houghteling found in her *Income and Standard of Living of Unskilled Laborers in Chicago* for estimates of family income made by housewives and members of the family in the home to understate the income actually received from employment and from other sources. (2) Despite the efforts made by the staff, it is evident, as frankly stated, that it was not possible to secure anywhere near as good a sample for those with incomes of over $5,000 and particularly for those with more than $10,000 a year as it was for the other groups.

The work nevertheless remains a major accomplishment both because of the size and inclusiveness of the sample and because for the first time it presents relatively authoritative material on the expenditure patterns of those in the upper income groups.

Briefly stated, the survey showed that 32 per cent of the Chicago families had total incomes of less than $1,000 annual income, 54 per cent less than $1,500, 72 per cent less than $2,000; whereas only 16 per cent received more than $2,500 and but 10 per cent more than $3,000. While 27 per cent of native white families had incomes of less than $1,000, 33 per cent of the foreign-born whites were below this figure and no less than 68 per cent of the Negro families. Furthermore, more than 12 per cent of the native-born white families had incomes over $3,000 a year, as had over 8 per cent of the foreign-born, but only 1.2 per cent of the Negro families.

The volume on expenditures classifies expenditures for the various main purposes by income groups and hence computes *average* percentages of income or total outlays spent for these purposes. This is in the manner com-

menced by Engel and continued by Carroll D. Wright and his followers. It does not compute income or budgetary elasticities of the type which have recently been developed by several students, namely, the proportionate change in outlay upon a given class of commodities divided by proportionate changes in the total income or the total expenditures.

The percentage of total expenditures spent upon food declined from 42 per cent in the $500–$750 group to 17 per cent for the group above $10,000. This showed, as we would expect, an income elasticity of very much less than unity. Similarly, the outlays on housing as such decreased from 34.6 per cent to 16.1 per cent. This also was a budgetary elasticity of appreciably less than unity. Household operation expenses on the other hand increased from 3.1 to 9.2 per cent and consequently had a budgetary elasticity of more than unity. This was also true of clothing where the outlays rose from 5.6 to 12.5 per cent. Two of the so-called "Engel's laws" as annunciated by Colonel Wright, namely, the alleged constancy of the percentages spent on rent and clothing, are thus seen to be erroneous, as some of my associates and I will also shortly demonstrate.

Transportation is an interesting item because of the inclusion in this category of the automobile. The outlays for this purpose increase from 3.1 per cent for the lowest group to 11.0 for the group between $5,000 and $7,500, but thereafter it declines slightly. It therefore has a budgetary elasticity of more than unity up to the income group in question and thereafter of less than unity.

The percentage spent on medical care increased in the main up to the $1,750 mark and thereafter moved irregularly until the $5,000 point whence it began to decline. The percentage spent on recreation rose to the $10,000 group and then, curiously enough, dipped downwards; the percentage spent on reading remained more or less constant up to the $10,000 point and then fell slightly. The proportion expended for education, however, rose from 0.2 per cent for all the groups under $1,250 to 3.4 per cent for those above $10,000. Contributions and personal taxes rose from 1 per cent to no less than 18.6 per cent for those over $10,000 a year.

One of the most interesting features of the study is the comparison between total expenditures and total income. For families under $1,750 a year expenditures exceeded income and the families had therefore net deficits or negative savings. This deficit in the case of the $500–$750 group amounted to 30 per cent, and in the case of the $750–$1,000 group to12 per cent. Once the $1,750 mark was passed, the surplus of income over expenditures rose from 2.2 for the $1,750–2,000 group to 35 per cent for those over $10,000. This should throw light upon many questions in the theory of savings, since it shows not merely that total savings increase as incomes increase, but that they increase much more rapidly than total income and hence have an income elasticity much greater than unity.

It is a pity that the Consumers' Purchases Study has not worked out and published such income or budgetary elasticities, but perhaps this may be done in later studies. Certainly the material is available for the most com-

plete analysis of budgetary and income data from this point of view which has ever been available. Let us hope that this need may be shortly met.

PAUL H. DOUGLAS

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Methods of Family Living Studies, by Robert Morse Woodbury. Washington, D. C.: International Labour Office. 1940. viii, 144 pp. $1.00.

This brochure on studies of family living illustrates its methodological conclusions with reference to 36 studies made in 29 countries since 1925. The chapters take up in succession the purposes of the studies, problems of planning, methods of collecting information, data needed, and analysis and appraisal of results. A special chapter on studies of food consumption goes into more detail concerning this part of family living. Appendices give tabular material concerning the 36 illustrative studies used, so that a student may compare his findings with those of others. The work is a handy reference book, supposedly printed to inspire the development of similar studies in other regions and other countries. *Studies of Family Living in the United States and Other Countries*, U. S. Department of Agriculture Misc. Publication No. 223, 1935, by Faith M. Williams and Carle C. Zimmerman, which is a more or less exhaustive monograph upon this same subject, is not mentioned here. Other important references are also neglected.

The weakness of this document is its lack of originality. It presents many issues but no guiding principles to solve most of them. In the discussion of planning, for instance, it is remarked that "a year of average prosperity is usually chosen" but other remarks are added to indicate that students do not always do this. The reviewer should like to know what a year of average prosperity is. Furthermore, why can't social scientists be encouraged to study life as it is? What this author says has been said *ad nauseum*. What ought to be said about family budget studies is seldom found in official reports. It has been several centuries since the Political Arithmeticians started such studies as these. The reviewer is of the opinion that, outside of technical details [we know more now about vitamins, etc.], the average outlook of the budget investigator is not up to that of the Political Arithmeticians. The reason is due in part to official reports such as this.

CARLE C. ZIMMERMAN

Harvard University

Productivity, Wages and National Income, by Spurgeon Bell. Washington, D. C.: The Brookings Institution. 1940. xii, 344 pp. $3.00.

This is the sixth in the series of Brookings' publications dealing with the general field of Distribution of Wealth and Income in Relation to Economic Progress. It comprises a study of capital investment, productivity, output, employment and wages in four groups of industries—manufacturing, railroads, mineral industries, and electric light and power. Similar series insofar as available are presented in separate chapters on the automobile, iron and steel, paper and allied products, cotton textile, and tobacco industries.

Throughout the volume there emerge certain fairly uniform patterns of behavior, which are illustrated in charts of noticeably similar appearance. Fixed capital usually declines from a high reached in the period 1926–1929; the curves showing output, number of wage earners, and man-hours steadily diverge like strands of a rope, while the curve of productivity, rising steadily throughout the period in all industries, forms a scissors-like pattern with the steady decline in unit wage cost. In almost every instance wages per dollar of product are lower in the late thirties than at any time in the twenties.

Chapter XI, summary and interpretation, gives the *leitmotif* of the volume: when productivity gains are passed on to consumers "an *inducement* is offered to consumers to buy more of the product in question, thereby tending to prevent any displacement of labor. The lowering of the price is a *positive* measure calculated to bring an immediate stimulus to demand. Such a stimulus is lacking when the only result of increasing productivity is to transfer income from displaced labor to the labor remaining in employment, or to the owners of capital" (p. 182; italics in original).

Nearly one-half of the volume is devoted to appendixes which discuss methodological problems, sources of data, and limitations of the various series. These will be of major interest to technicians, in particular, Dr. Bell's technique which Dr. Moulton and Miss Cleona Lewis label as of "dubious economic significance" whereby changes in man-hours of wage labor are used as a basis for measuring gains to the other factors of production. By this method he not only measures in millions of dollars the share of the productivity gains which the various producing factors have received but separates the amount due to rate changes (which uniformly shows increases in the share of wages and, with the exception of automobiles, decreases in the rate of earnings on capital) from the amount of rise due to shift in factor proportions (which uniformly indicates a displacement of labor by capital).

In all instances capital investment per unit of output seems to have declined. Indeed, in the automobile industry the process of disinvestment began in 1926. The reasons given by Dr. Bell are "organizational improvements which require no new capital," "decrease in the cost of capital instruments because of the universal character of the increase in productivity," "improvement in size, quality, and design of capital instruments" (p. 208).

The fact should be noted—and in an article by Dr. Mordecai Ezekiel soon to appear in the *American Economic Review* the point is proved in detail—Dr. Bell's results would be substantially different if, instead of taking the whole twenty-year period he had made a division at the year 1929. For prior to that year the share of the gains passed on to consumers was much less. In fact, in the highly centralized industries, automobiles, steel and tobacco, the overwhelming proportion of the gains in the twenties went to capital, that is, to the recipients of dividends and interest. This was corrected to a substantial extent in the thirties. In the decentralized industries, on the other hand, that is, in the cotton textile and paper and pulp industries, nearly all productivity gains were passed on to consumers throughout the period. Ob-

viously, Dr. Bell's analysis ought to be widely extended as indeed it may well be when the available statistics for American industries in general reach the quantity and quality now available for automobiles and cotton textiles. For it is only by painstaking studies of this character that sufficiently detailed knowledge will be obtained for the intelligent formulation and efficient administration of wise economic policies.

Theodore J. Kreps

Stanford University

Savings in Great Britain, 1922–1935, An Analysis of the Causes of Variations in Savings, by E. A. Radice. New York: Oxford University Press. 1939. iv, 146 pp. $3.25.

This is one of a series of "studies of special economic and social questions, carried out by research workers in the Faculty of Social Studies at Oxford."

The author presents in brief compass a valuable summary of the data for Great Britain on savings and related financial variables. With these as a background, a lucid sketch is given of the high lights of English and Continental monetary theory, attempting to "explain" the more or less dynamic interrelations of savings, income, interest, and investment. A resolute effort is made to obtain definitive tests of the theories by multiple correlation analysis, the latter somewhat dated, but sharpened by recent refinements.

The data on savings of individuals, of business, and of social and Government institutions are presented in relation to price level, income, and such detailed investment factors as real estate, bank deposits, gold imports, and shipments. This material is valuable in itself and affords a useful comparison with corresponding American data, such as the recent study by Goldsmith contributed to Volume III of *Income and Wealth* (National Bureau of Economic Research, 1939.)

Sundry important factors affecting—and influenced by—savings are succinctly sketched, such as the distribution (concentration) of incomes and its variation in time and the Keynes "multiplier" (the ratio of income increment to investment increment) and its time trend; a statistical examination of each being attempted for British and also American data. The analytic survey of the data by balancing money savings against financial claims (Chap. XI) follows the theoretical procedure of Marschak and Lederer (*Kapitalbildung*, 1936). This affords an interesting comparison with similar "balance sheet" analyses of American data such as those of Dickinson and Eakin, and Leontief (Goldsmith study, above, p. 225).

The statistical prodecure follows the multiple correlation forms—with some Fisher and Frisch wrinkles—familiar in American studies of purported supply-demand relations, in vogue before the advent of analysis by variance. Most of the results are frankly shown as inconclusive (pp. 32, 54, 59, 133), and of little significance—even where the "z-test" is favorable. The author's sacrifice in formidable computation effort serves the valuable purpose of demonstrating the meager utility of economic analysis by "regression" meth-

ods—plain or "confluent." In a dynamical set-up neither simple nor multiple correlation is helped by purported tests of "significance." The author's negative results demonstrate that a test of *relevance* would be much more useful.

The author sensibly evades abstruse snarls of current economic and statistical theorizing of preceding chapters to present a realistic concluding survey of the effects of monetary policy in relation to savings and public policy.

MAX SASULY

Social Security Board

The Canadian Balance of International Payments, A Study of Methods and Results. Ottawa: The Dominion Bureau of Statistics. 1939. 251 pp. $1.00.

This very useful work presents the Canadian balance of payments for the 12 years, 1926–37, analyzed on the basis of studies that have extended over a considerably longer period. Since its publication, data for 1938 and 1939 have also been issued in mimeographed form by the Dominion bureau.

It begins by summarizing the historical development of balance of payment studies in general. This is followed by discussion of the three essential parts making up a complete statement of the international accounts of any country, and the various purposes to be served by such a statement for Canada. The rest of the monograph is devoted to a presentation of Canadian data, and the methodology employed in the collection and analysis of these data.

Of particular interest are the pages devoted to the question of the method of valuation that should be used for the items included in the international balance sheet of a nation—whether capitalization, capital employed, capitalized earnings, par value, book value, market value, replacement value, or original value. For the study in hand the authors decided in favor of "capital employed," since the valuable basic data provided by the industrial census are in terms of capital employed. Other questions of methodology are considered in connection with other items in the accounts.

Next to merchandise exports, the tourist trade represents the largest source of international income for Canada; and after merchandise imports, interest and dividend payments rank second among the outgo items, with shipping charges third. Other commodity and service items are of relatively minor importance. Capital movements are shown for the 13 years, 1927–39. In 10 of these years Canadian repayments on earlier borrowing and Canadian investments in other countries exceed new foreign and British investments in Canada; while in three years the effect of such transactions was to increase the net amount of Canadian external indebtedness.

The international balance sheet, which is presented for the 12 years 1926–37, shows that Canada's external "debts" increased from 5.9 billions in 1926 to a high of 7.2 billions in 1930, and thereafter decreased to 6.8 billions in 1937. Meantime, the external investments of the country increased, with some minor fluctuations, from 1.4 billions in 1926 to 1.8 billions in 1937. The

geographic analysis of the two sides of this balance sheet shows the close tie existing between Canada and the United States. Her obligations to American investors are one-third greater than to British investors, while her investments in the United States are almost 27 times as great as those placed in the mother country. With reference to both the United States and the United Kingdom, Canada is a net debtor. At the close of 1937 the amounts involved were about equal, at 2.8 billions for the United States and 2.6 billions for the United Kingdom. At the present Britain's investments have been lowered by her liquidations, while the American figure undoubtedly has increased. With reference to all other countries taken together Canada's investments exceed her obligations—the net amount in 1937 standing at about 500 million dollars.

CLEONA LEWIS

Brookings Institution

Occupational Counseling Techniques, Their Development and Application, by William H. Stead, Carroll L. Shartle and Associates. New York: American Book Company. ix, 1940. 273 pp. $2.50.

This interesting book is essentially a systematic account of the research conducted by the Worker Analysis Unit of the Occupational Research Program of the U. S. Employment Service. The major responsibility has been carried by the two senior authors but eight persons collaborated in writing the book and still others served as technical consultants in the research. The program was three-fold: proficiency tests, aptitude tests, and relationships between jobs from the standpoint of counseling. Several requisites imposed by the nature of the Program were observed: the tests must be applicable in different parts of the country; they must deal with occupations that employ large personnel; a given test must apply to many occupations so as to be widely useful in guidance; the tests must be brief,—12 to 15 items in a trade test.

Readers slightly familiar with the field of vocational testing will find the book valuable as a survey of conventional research procedures,—almost a manual. Those experienced in the field will be interested in numerous variations and improvements of methodology recounted. For instance instead of developing aptitude tests for one job at a time the ORP (Occupational Research Program) often took several jobs simultaneously and developed tests which had validity for all of them. The emphasis obviously is on the ultimate use of the tests for guidance rather than solely for selection. The authors stress the fact that vocational counselors should not be allowed to use such tests until adequately trained. The reviewer, mindful of what happened in the testing field in 1919, heartily seconds the motion.

Development of oral trade tests constituted a considerable part of the program. Improvements over the tests inherited from the last war include the computation of reliabilities between two forms of the test (when available) and determining the best types of questions, such as those dealing with definitions, limitations, use, and location of materials involved in the trade.

This list of types should be useful to persons in the process of devising other trade test items.

A chapter on rating-forms presents in some detail a variety of rating-scales and even the forms used in compiling lists of qualities to be rated. The scales for rating salespeople and interviewers will be of especial interest. These scales at first glance look like the conventional graphic scale but the rater checks in brackets below the appropriate phrase rather than checking anywhere along the line. Furthermore the phrases do not extend from a high to a low rating across the page but are mixed so that the rater will have to read them all. Why the above form was used rather than the conventional graphic scale is not explained in the text. At any rate the reliabilities reported with this form compare favorably with those of other rating scales.

The discussion of the criterion gives a systematic classification of available data. There is an interesting list of criterion items for retail sales clerks such as sales, quota, bonus, errors in computation, shopping report grades. The chapter on construction of aptitude test items is centered around department store sales persons. It includes a good summary of the literature on tests for that particular job.

Then follows a rather detailed description of the process of analyzing the data statistically, with the more technical details in the appendix. An interesting procedure was followed when the weights for tests or items derived with one sample gave low validity in another sample. Items having weights in the same direction in all samples were segregated and given a weight corresponding to the predominant one. In that way the battery had some validity in all three samples (department stores). The development of tests for clerical workers followed conventional lines.

The final problem of the program deals with occupational relationships or patterns. The results are based on job analyses in which experts rated jobs after observing workers. The analysis involved 47 characteristics which were rated as to the amount of each demanded of the worker in a given job. The blank used in this analysis should be of general use to other job analysts. The data were recorded on special cards and coded with a hand punch. Common factors could be located by inspection of the pile of punched cards. The practical result was a series of families of occupations such as those "requiring *B*-amount of dexterity but no minimum formal education, special knowledge, experience or accuracy." These families have obvious uses in guidance. Further study reveals greater possibilities of transfer across industrial lines for unskilled physical labor, less for semi-skilled etc. up to the least for professional workers, with however a reversal beyond that and some transfer possibilities in the executive field. The authors look forward to an ultimate code book for locating these families of occupations knowing the qualifications of the counselee.

Like most research accounts the text concludes with an indication of further problems—perfecting further the aptitude tests, making a broader coverage of patterns of related occupations, and improving interview techniques.

The eight appendices give some of the technical details and procedures mentioned in the text and portions will be of particular interest to statistical readers. No. 1 involves a method of determining critical points in trade test scores by finding scores that make the greatest differentiation between percentile scores of experts and non-experts. No. 2 will be quite useful to vocational psychologists. For 26 tests it gives validity correlations with from 1 to 34 job criteria and also the number of subjects, the mean and the standard deviation. A supplementary table gives the nature of the criterion used. This appendix will help avoid lost motion on the part of other researchers developing aptitude tests. No. 3 gives the ORP method of computing a correlation from a scatter plot. It employs X-Y and the counting of frequencies along the diagonals of the plot. No. 4 is a work sheet for computing intercorrelations. No. 5 gives the Wherry-Doolittle method for selecting and weighting tests in a battery. It modifies the usual Doolittle method for solving normal equations and has a method for measuring the chance error introduced by each variate and the amount each contributes to the final multiple correlation. It adds the tests to the battery in the best order and, like the Toops Multiple Ratio method, gives the cumulative multiple correlation. The statistical work is less than in the Toops method. Nos. 6 and 7 show how to weight interest items such as those in the Strong questionnaire. No. 8 gives a method for correcting industrial production data for individual experience. It assumes that the practice curve starts with the usual negative acceleration but then has a portion that is straight and sloping upward to the point where it levels off. The boundaries of this straight portion are to be found by inspection of a specific plot of experience against production and the correction essentially transforms a given worker's production back to the beginning of this straight line region. This is all right if the curve for a given job actually conforms to the foregoing. The authors simply state that "there is approximately a straight line relationship." Data for other jobs beside those investigated here will reveal whether this type of curve is quite general.

The book will fill a very useful place. While the description of methods is for the most part conventional it does give a good summary of procedure in an up-to-the-minute setting. The discussion will be elementary for the more technically trained reader but a very good outline for the beginner. In short it could almost constitute a manual for a researcher in this field. Even the technically trained will find some stimulating suggestions and original variations of conventional procedures. The work would also constitute a good reference book for academic courses in vocational psychology. However the free-lance counselor should not be misled into thinking that it will provide him with a set of instruments for his practical work. Unless he knows a good deal about tests and has had sufficient training in their interpretation he will find the book "over his head." For persons undergoing training in the U. S. Employment Service for counseling positions in the organization the book is admirable. Such persons will doubtless call it "the Bible."

HAROLD E. BURTT

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Statistical Analysis in Educational Research, by E. F. Lindquist. Boston: Houghton Mifflin Company. 1940. xi, 266 pp. $3.00.

This book presents some of the uses of analysis of variance in the field of educational research. It is perhaps one of a number of statistical books which may be expected introducing R. A. Fisher's methodology and showing its applicability to some particular field of study.

Little mathematical background is required unless one wishes to read the papers giving the derivation of the various functions. There is merit in getting such research techniques into the thinking of those with little mathematical training, since much research is done by them.

The book is divided into seven chapters. Of these the fourth, "The Importance of Design in Educational Experiments" is perhaps the most significant. The discussion of sampling in the first chapter points to a distinction between random sampling and random selection, infrequently recognized by research workers in education. For example, the author notes that the unit of sampling in educational research is often the class, the school, or the community rather than the pupil. Such topics have generally received inadequate treatment in educational statistics textbooks.

Detailed directions for computation of various functions are given. In some instances the computational techniques could be improved in the direction of efficiency in computation.

HAROLD A. EDGERTON

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Graphische Tafeln zur Beurteilung statistischer Zahlen, by S. Koller. Dresden and Leipzig: Verlag von Theodor Steinkopff. 1940. 73 pp. RM 7.50.

This useful book by a medical statistician presents nomograms for various statistical distributions. These include the normal distribution, χ^2 distribution, distribution of the correlation coefficient and analysis of variance distributions. Numerous well chosen examples taken from practical applications should facilitate the use of the book.

GERHARD TINTNER

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Tuberculosis and Social Conditions in England with Special Reference to Young Adults, by P. D'Arcy Hart and G. Payling Wright. London: National Association for the Prevention of Tuberculosis. 1939. 165 pp. 3*s*.

Shortly after 1920 the Medical Officer of Health for the County of London pointed out that the death rate from respiratory tuberculosis among young adults 15–24 years of age, especially young women, had practically ceased to decline. Analysis of the data for the entire country showed a situation similar to that in London, and by 1933 the check to the decline in the mortality from respiratory tuberculosis among young adults was regarded as one of the major problems in combating tuberculosis.

The authors of this book seek for the causes of the setback in the improve-

ment in health by a statistical analysis of concomitant changes in social and economic conditions. The analysis is divided into two parts. The first surveys the trend in the mortality rates from respiratory tuberculosis for the entire country, extending as far back into the last century as available data permit, in conjunction with the trend in real wages, substandard housing, and the proportion of persons in industry. The second part is an intensive examination of differences in mortality rates among the county boroughs (urban administrative areas) of England and selected indices of social conditions—migration, the percentage of persons receiving poor relief, the percentage of the population living more than two per room, and a social index based on the occupational distribution of the population.

The principal methods of analysis are graphic comparisons of time series and correlation. The authors suggest that the check in the decline in mortality from respiratory tuberculosis among young adults may be accounted for by the check in the rate of improvement in the standard of living which occurred about 1900 and which was accompanied by an increasing proportion of young women entering gainful employment. The comparison of mortality rates in the various urban boroughs showed that the slowing up in the rate of decline was greatest where overcrowding and substandard housing were most common.

The statistical work has apparently been carefully done. A detailed appendix describes the source of the data utilized, their limitations, the method of constructing the various indices and time series and the statistical technique used in the analysis.

The pitfalls in the statistical analysis of time series have been frequently emphasized and need not be elaborated here. The authors are fully aware of these and exercise caution in drawing their conclusions. If the positive results appear meager in comparison with the labor involved in the statistical calculations, it should be attributed to the nature of the problem and the lack of data rather than to the authors who have handled a difficult statistical problem in a competent manner.

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PUBLICATIONS RECEIVED*

AITKEN, A. C. Statistical Mathematics. New York: Interscience Publishers, Inc. 1939. vii, 153 pp. $1.50.

AMERICAN ASSOCIATION OF COLLEGIATE SCHOOLS OF BUSINESS. Proceedings of the 22nd Annual Meeting. School of Business Administration, University of Texas. 1940. 136 pp.

ARKIN, HERBERT, and COLTON, RAYMOND R. Graphs, How to Make and Use Them. New York: Harper & Brothers. Revised Edition. 1940. xvi, 236 pp. $3.00.

BEAN, LOUIS H. Ballot Behavior, A Study of Presidential Elections. Washington, D. C.: American Council on Public Affairs. 1940. 102 pp. $1.50.

BERNSTEIN, BLANCHE. The Pattern of Consumer Debt, 1935–36, A Statistical Analysis. Studies in Consumer Instalment Financing, No. 6. New York: National Bureau of Economic Research. 1940. xviii, 238 pp. $2.50.

BONBRIGHT, JAMES C. Public Utilities and the National Power Policies. New York: Columbia University Press. 1940. vi, 82 pp. $1.25.

BRANDT, KARL. The German Fat Plan and Its Economic Setting. Stanford University: Food Research Institute. 1938. xii, 344 pp. $3.00.

BRANDT, KARL. Whale Oil, An Economic Analysis. Stanford University: Food Research Institute. 1940. xi, 264 pp. $3.00.

CLARK, COLIN. The Conditions of Economic Progress. New York: The Macmillan Company. 1940. xii, 504 pp. $5.00.

DAHLBERG, GUNNAR. Statistical Methods for Medical and Biological Students. New York: Interscience Publishers, Inc. 1940. 232 pp. $2.75.

FERGUSON, DONALD G., FRANCIS, BION H., HARWOOD, E. C., MANTON, BENJAMIN D., and THEIR ASSISTANTS. What Will Inflation and Devaluation Mean to You? Cambridge, Massachusetts: American Institute for Economic Research. 1940. 144 pp. $1.00.

FOOD RESEARCH INSTITUTE. World Wheat Survey and Outlook, September 1940, by Helen C. Farnsworth and V. P. Timoshenko. Stanford University, California: Wheat Studies of the Food Research Institute. Vol. XVII, No. 1. September, 1940. 37 pp. 75 cents.

GAFFEY, JOHN DEAN. The Productivity of Labor in the Rubber Tire Manufacturing Industry. New York: Columbia University Press. 1940. 204 pp. $2.50.

GLASSER, CARRIE. Wage Differentials, The Case of the Unskilled. New York: Columbia University Press. 1940. 169 pp. $2.00.

GREEN, HOWARD WHIPPLE. Cleveland Market Data Handbook. Cleveland: Real Property Inventory of Metropolitan Cleveland. 1940. 53 pp. $1.00.

HAMILTON, WALTON H. The Pattern of Competition. New York: Columbia University Press. 1940. vi, 106 pp. $1.25.

HARDY, CHARLES O. Wartime Control of Prices. Washington, D. C.: The Brookings Institution. 1940. x, 216 pp. $3.00.

HARPER, F. A. Analyzing Data for Relationships. Ithaca, New York: Cornell University Agricultural Experiment Station. 1940. 14 pp.

HOLTHAUSEN, DUNCAN MCC., in collaboration with MERRIAM, MALCOLM L., and NUGENT, ROLF. The Volume of Consumer Instalment Credit, 1929–38. Studies in Consumer Instalment Financing, No. 7. New

* Annual reports and publications presenting statistics collected at regular intervals have been omitted from this list. Some items of minor interest to statisticians have also been omitted. The contents of periodical publications are not listed, but the attention of the reader is directed to the lists of articles in current publications which are to be found in the *Revue de l'Institut International de Statistique*, *Journal of the Royal Statistical Society*, *American Economic Review*, *Population Index*, *Transactions of the Actuarial Society of America*, *The Record of the American Institute of Actuaries*, and *Sankhyā, The Indian Journal of Statistics*.—Editor.